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ABSTRACT

Intended to aid in the building or purchase of a home suitable for use by a handicapped individual in a wheelchair, the booklet provides detailed design guidelines. Included is information on the decision process, finances, ramps, a car shelter, doors communication devices, electrical needs, windows, elevators and chair lifts, the kitchen, an exercise area, the laundry, storage, floors and floor coverings, the bathroom, the bedroom, mobility in the home, three demonstration houses, alteration of a builder's plan, the wheelchair, and safety. Also included are a listing of 12 relevant books, and sources of special equipment. (DB)

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house design ideas for easier wheelchair living

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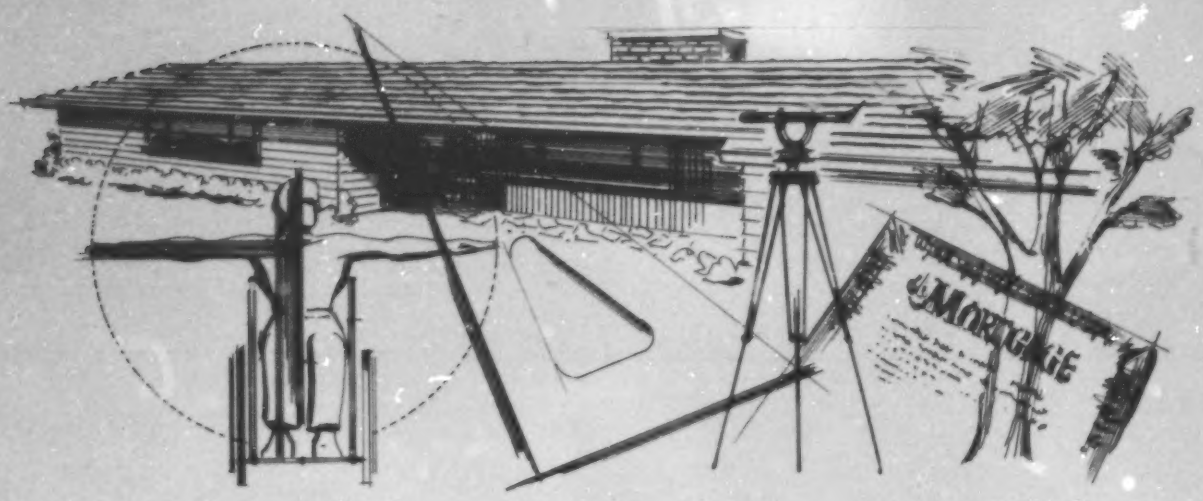

FIRST THOUGHTS

You are planning to build or buy a home. For any family it is a major undertaking. If a wheelchair is involved, even more than the usual investment of planning time, energy and financial judgment is required. In contemplating a wheelchair home—that is, a house planned for functional wheelchair living—some key questions must be asked.

Who will live in the house? Most houses are family affairs. There may be one or more adults, and perhaps children, in addition to the handicapped person. A house designed and equipped for the greatest potential in comfort, convenience and independence for the chairborne resident will in no way impede the rest of the family. It need look and function no differently from any other house and, indeed, will probably be more comfortable for *all* family members. It will be just as saleable as any house in its class should it ever have to be placed on the market.

Another question: **How much can you afford?** When buying, building or remodeling *any* house, what you are prepared to spend makes a great difference in what you get. And any special features for easy wheelchair living will probably add to the cost. The extra dimensions to accommodate the maneuvering of the chair, the added equipment not customarily included—the need, for example, for specialized hardware and the like—these swell the budget.

An early decision with respect to cost will be: How do you plan to acquire your new home?

. . . Will it be a matter of buying a piece of land, calling in an architect and guiding him in designing from the ground up?

. . . Or will you have to find a development builder who has created an adaptable model or models, choose one, and induce him and his architect to modify the building plans for a wheelchair user?

. . . Or will you look for an existing house that fits the basic requirements for wheelchair use, and make the necessary structural changes for your needs?

The decision can be based only on, first, your financial status and second, what is available in your cost range for each of the three possible approaches.

Who makes the plans? Whether you build a custom-designed house, alter a builder's plan or adapt an existing house, half the battle is finding an architect and builder willing to think in wheelchair terms. Few such people are familiar with the physical problems involved. But if the architect you engage is willing to learn, ready to ask the proper questions and probe for your special needs, that is what you want. Then he can apply his expertise in laying out a functional, attractive design to solve the problems.

In addition, the advice of a rehabilitation specialist, such as an occupational therapist, should be sought. If this person has already worked with the handicapped individual involved, and thus knows his capabilities and limitations, his or her aid will be indispensable.

The most vital question is: **What does the wheelchair person need?** The aim must be freedom—freedom to move about his house, to come and go in the outside community, to work and live without barriers that block his wheels. Dimensions must be such that virtually everything he needs and uses is within his reach when seated in a chair. In addition there should be the means for instant communication, at any hour of the day or night, with others in or outside the home.

Before anything else, the chairborne person who will live in the house must be studied intensively. Needs must be analyzed, capabilities measured, limitations counted. Also to be considered are his activities and life style. What does he expect to do in the immediate and more distant future? Will a man do his work at home, or elsewhere? Will a woman be the homemaker?

The study will include many things: an assessment of the strength of the individual's arms for maneuvering himself and a wheelchair; the length of his reach; the power of his fingers in grasping. Many more specific details to be considered will include, perhaps, the implications of his need to use an electrically powered chair, or the method he uses in getting into and out of an automobile, whether as a passenger or the driver.

In the pages that follow, the possible means for meeting the needs presented by each of the factors discovered by the individual analysis will be discussed in detail.

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STEP BY STEP DECISIONS

For the wheelchair person, the proper house can afford an environment for living that is possible nowhere else. But, in planning, there are pitfalls to be avoided. There are large and small decisions to be made. There are facts to be learned, faced and digested.

Step by step, here are some of the facts to be determined and the decisions to be based on them.

FINANCES

How much can you afford to pay for a house? Essentially, it narrows down to two figures: (1) the amount you have available for a down payment, and (2) how much you can allocate from your monthly income for the mortgage payments. The size of a mortgage available for the monthly payments you can make, together with the amount of the down payment, add up to a close approximation of the price of a house you can afford.

To reach that figure, ask first, what is the family's net monthly income from all sources (after withholding taxes and other deductions). What are your assets other than income? What are they likely to be in the future?

Now subtract from your net monthly income your *average*, normal monthly expenses of living, such as food, clothing, medical, insurance, recreation, travel, car expenses, plus a reasonable allowance for miscellaneous non-housing items. The remainder will be your monthly income available to pay for future housing. Bear in mind, however, that *housing* costs will include not only the regular payments of interest and principal on the mortgage, but also property taxes, fire and liability insurance, heat and utilities, plus repairs and maintenance, both interior and exterior. And don't forget furnishings and landscaping. Will the new location make necessary a second car for family use?

Vitally important: Do not buy or build a house that is beyond your means. The struggle to maintain it will surely negate the physical advantages it has to offer. Buy what you can afford. Live comfortably for today, and, as so many members of the PVA have done, upgrade in the future to fit new conditions, a new location or a new way of life.

Builder's Model. If, as is very common, you decide to modify for wheelchair use a builder's model in a new development, the down payment, the probable amount of the available mortgage and the monthly payments may be learned from the builder, if he has worked out such arrangements with a bank. He can estimate the additional costs, if any, for the modifications you require, which can be included in the overall mortgage arrangement.

We strongly recommend, however, that you do some comparison shopping at other banks before settling on your mortgage source. And be sure your comparisons include *all* the add-on costs each lender will charge. Then there will be closing costs: legal fees, title search, taxes and so on. The builder can probably help you put together a fairly accurate figure for the whole package.

Existing House. Buying an existing house for modification to meet wheelchair needs will involve an equivalent list of costs. Finding one that is adaptable without too much alteration will not be easy. When you think you have found one, you will be wise to have the house of your choice inspected by a professional engineer for possible defects in structural

4

quality, plumbing, heating, electrical and ground-water conditions. The small fee involved will be well spent if the inspection shows a house in good condition—or warns you away from one that will require very costly repairs.

The most difficult items to estimate will be the expense of alterations to make the house fully wheelchair-livable. That may call for such things as a special entrance ramp, wider doorways, a new bathroom, or rebuilding the kitchen. Each will need an estimate of a contractor.

Try to finance both the house and the alterations in one mortgage. But if you must take over the previous owner's mortgage, shop around at a number of banks for the most favorable terms for your home improvement loan. Don't lose sight of the fact that the cost of your house is the sum of the purchase price *plus* alteration costs.

Custom House. For the few who can afford the luxury of a custom-designed house, the budget must include the price of the lot, the architect's fee, the costs of building materials and construction, installation of utilities, fixtures, major appliances, outside walkways, driveway and landscaping. Again, add various legal and closing fees on the property. Your architect will have to provide complete sets of the very detailed plans that he has worked out with you. These sets will be sent out for bids by building contractors before you can have a realistic estimate of construction costs.

Bear in mind that it is difficult to stay within a budget when you are starting from ground up. Unexpected expenses invariably turn up, especially in an inflationary market. Although your architect can provide a rule-of-thumb figure for current cost-per-square-foot of enclosed living space in various quality categories, it is good practice to design for total square footage well under the indicated area, in order to allow for the extras that will be needed for wheelchair living.

LOCATION

What locality should you choose? Avoid heavily-traveled main arteries. Look for a quiet side street in a residential neighborhood protected by zoning regulations. You do not want future encroachments of industrial, commercial or other activity; these might be detrimental to the use, safety, enjoyment potential and resale value of the property.

Is your location close to necessities such as shopping, schools, hospital, recreational, religious and cultural facilities? Other services? Is it within reach of places of employment? Are the streets of the neighborhood well lighted and adequately serviced? Are nearby homes and lawns well kept? You must consider that the value of your house should be in keeping with the other homes in the vicinity, for your own comfort and for future saleability. Would you and your family be at ease with the people you see living there?

If you are custom building, consider that the cost of the lot, if it is a good location, may be out of line with your budget. Paying too much for the lot means less available for the building.

What specific site will you select? Whether you choose a development house, an existing house, or a lot for building, the first thought is for wheelchair accessibility. The site should be reasonably level or capable of grading to levelness. Sometimes ingenious things can be done in creating a house design to make a sloping terrain wheelchair-usable, but it is not wise to count on the possibility. (See an interesting example in Demonstration House Number One.)

The shape and size of the site should be adequate for a one-level floor plan, which generally requires more space than a multi-level house. It is a good idea to consult your architect before buying a site for building.

If ramping will be necessary, adequate space must be available to allow for a very slight incline: no more than 1 inch rise for every 12 inches of length. Makeshifts such as an outside elevator may be unavoidable in modifying an existing building, but should never be considered in new construction.

More about the site of a new house: Consider borings and soil tests. You want to know: Whether filled land or a sandy subsoil will cause the foundation to settle and crack in the future; whether the soil drains well or retains water—important particularly if you must put in on-site sewage disposal, such as a septic tank; whether the ground-water level makes a basement possible. (Ask for advice from the local office of the Soil Conservation Service, U.S. Department of Agriculture.)

Is there sufficient topsoil to support grass and landscaping? If not, you will have to buy and bring it in.

Does the area have a history of or potential for flooding? A low spot on the bank of a small stream or drainage ditch may look charming—until the spring run-off starts. Check carefully; the stream may no longer be there, having been bulldozed away, but piled-up rainwater seeking an outlet will remember it.

Maintenance problems in the future will mean not only annoyance but expense. Your site may have a low purchase price because future maintenance costs are likely to be high.

RAMPS

Ideally, a house designed for wheelchair accessibility is on a level site, with no more slope than necessary for effective drainage. The approach to the entrance door and other walkways are at least 42 inches wide, and any gradient no more than 3 percent (an inch of rise for every 30 inches of length).

When the ideal is not available, however, and the pitch is greater than 1 in 30, one or more ramps may be required. The slope of a ramp must not exceed 1 inch in 12 inches of length. A ramp must be constructed of concrete or other permanent, weather proof material and provided with a non-skid surface.

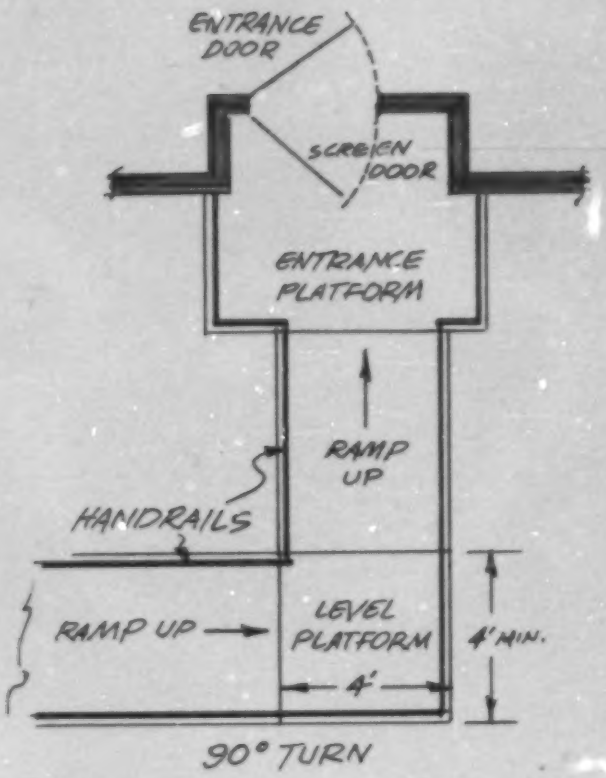
Level platforms for resting should be included on a ramp that:

. . . is excessively long (to provide a breather for a wheelchair person with limited arm strength).

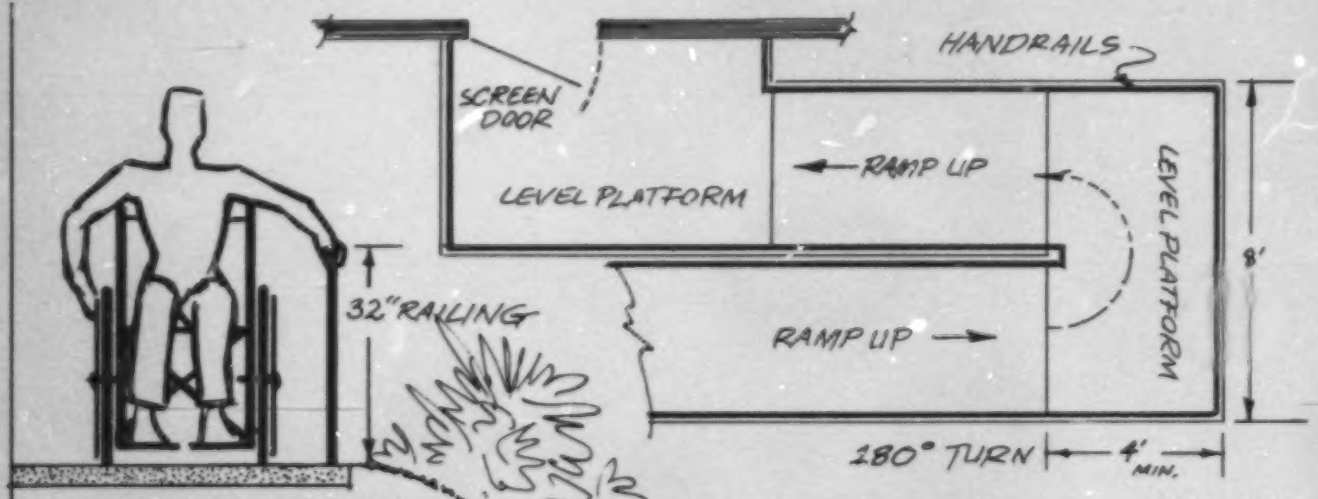
. . . has a sharp change in direction.

. . . approaches a door. To allow ample room for opening, the platform before a door should be at least 5 feet by 5 feet. It should extend alongside the door at least 1 foot—preferably 18 inches—on the side next to the door handle, to permit positioning a wheelchair so that an outward-swinging door can be opened without backing up.

Either a curb or railing, or both, should be run along the edges of a ramp to prevent a wheelchair from going over accidentally, especially where a steep drop-off is involved. A handrail should be 29 to 32 inches high, depending on the arm reach of the chairborne individual. He can use a railing to assist mobility, which is an advantage it has over a curb alone. The handrail should extend slightly beyond the ramp at top and bottom, but care must be taken that the extension is not a hazard to passersby.

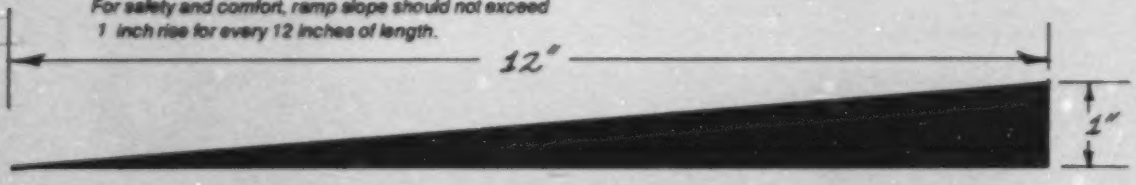


Level landing platforms are needed for sharp change of direction and at approach to door.



Guardrail should be installed on ramp where there is a steep drop-off.

For safety and comfort, ramp slope should not exceed 1 inch rise for every 12 inches of length.



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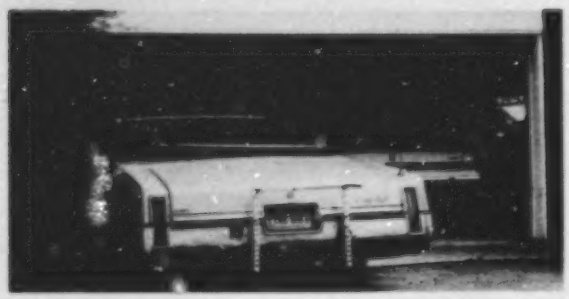


B

C

CAR SHELTER

The garage or carport should consist of an almost-level parking platform (with a very slight slope for drainage) that is level with an entrance door to the house. It should be wide enough to allow at least 4 feet on one side of the car; this is to permit a car door to be opened full width for the chairborne person's transfers to and from his chair.

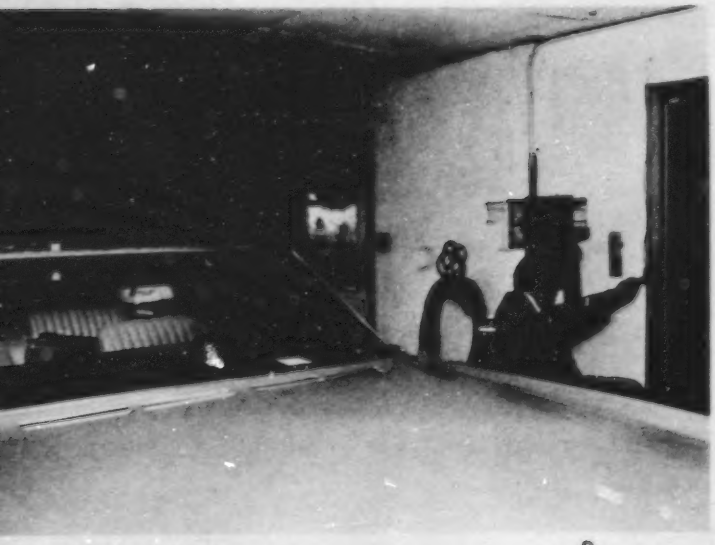
Preferably, the garage or carport should be designed for close and direct weather-protected passage from the car into the house. If the car shelter is not directly connected to the house, there should be a covered way between them to ward off bad weather conditions.

Important in designing the shelter is the question of whether the wheelchair person enters and leaves the car through the door on the driver's side or the passenger's—especially if he drives a hand-controlled car and handles the wheelchair himself. It is usually difficult or impossible for the individual to change this pattern. The car side he uses, therefore, should have direct access to the house door. Passing around in front or rear of the car may be difficult even when a garage is long and wide enough to permit it—which most are not.

An electronic garage door operator is a necessity for the wheelchair user, particularly one who drives a hand-controlled car. While safely inside his car and protected from the weather, he uses the device to open or close and lock the door from up to 75 feet away. This works by means of a button on a small hand-held radio transmitter. It automatically turns on the light in the garage as the door is being opened, and turns it off after a preset interval (usually about 1½ minutes) once the door has closed.

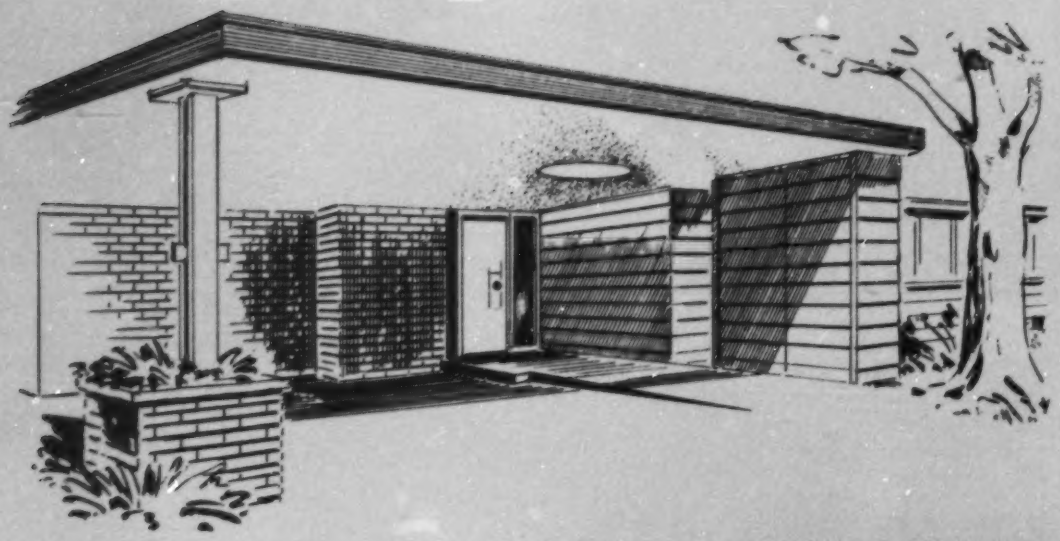
In addition, there must be a wall switch inside the garage to open or close the door. The door must also be movable by hand in case of a power failure. A necessary safety feature is the capability of an electronic door to reverse its motion automatically if it touches an obstruction while closing.

A. Electronic garage-door opener works from inside the car. B. Car pulls into garage next to a low ramp-curb (not visible in picture) to its left. C. Wide ramp gives adequate space to maneuver chair. D. Garage door is closed by switch on wall next to entrance door. E. Wheelchair resident enters house through kitchen door.



D

E



2-car carport. 4½ foot wide ramp permits easy wheelchair transfer to and from car and direct approach to 5 foot square level platform at house entrance. Circular skylight brightens entrance. Recessed ceiling lamps light carport at night. 2-door garden tool closet at right.

To overcome a three-step difference between an existing garage level and the house entrance door, a vertical lift was installed to raise the wheelchair to a newly-built wooden platform (not visible in picture) at door level. Also not visible are the steps on the far side of the platform for use by other family members.

This two-car garage has a separately-controlled electric door for each car. Both husband and wife of the house drive hand-controlled cars. A standard 36-inch-wide side-hung door is between the garage doors; note that trash inside the garage can be removed by opening that door. Photo taken from connecting doorway to house.

DOORS

Even an open door may, for a person in a wheelchair, be hopelessly shut—too narrow for the chair to pass through. In many instances, the width of the doorway itself may be adequate, but someone has failed to remember that every doorway is narrowed to a greater or less degree by the bulk of the door itself when standing open. The amount of obstruction varies with the door style.

A side-hung, hinged door of the most common type when fully open reduces the "clear opening" of the doorway by the thickness of the door—approximately 2 inches. Thus, a 36-inch doorway actually has a clear opening of 34 inches. Where this 2 inches could provide the critical extra width to permit passage of the chair, special hinges that swing the door out of the frame and to one side, permitting full clearance of the opening, are available to replace the ordinary ones.

Other styles of doors for homes—folding, swinging and accordion types—cause varying reductions in the opening. Only a sliding door that disappears completely into or alongside the wall will leave the clear opening unreduced. For this, special hardware should be installed in the visible edge of the sliding door to draw it back out, in addition to the usual fingerholds on the sides.

Along with the style, door locations and accessories must also be considered:

ENTRANCE DOORS must be at least 36 inches wide, that is, having a 34-inch clear opening. This is generally standard for residence entrances and in some places is required by construction law.

Since an entrance door opens inwardly, the screen or storm door must open out. Therefore, there must be enough room on both the inner and outer sides of the doorway to allow for positioning the wheelchair properly; that is, to permit the door to swing open toward it, without forcing it to back away. Such an easy door-opening maneuver requires about a foot or a foot and a half of extra space on the doorknob side of both the entrance platform and the inside hallway.

The approach to the door from both outside and inside must be level. No step up or step down. No door sill, or at least nothing higher than a half-inch. Where weather-stripping is essential, types such as automatic door bottoms and weather seals are available to meet this need. (See illustration).

The house door, screen door and storm door all must open a full 90 degrees. Most pneumatic storm-door closers will not permit such an opening and are difficult to operate from a wheelchair anyway, so a simple light weight spring or elastic closing device may be advisable. A problem is that this may cause the door to close with a bang.

A doormat just outside the door must be recessed to be flush or almost flush with the entrance platform.

If the wheelchair occupant customarily uses the footrests on his chair to push a door open, an aluminum, stainless steel or brass kick-plate may be installed at the base of the door.

INTERIOR DOORS should have a clear opening of at least 30 inches, preferably 34 inches. If a wheelchair must pass through at an angle, rather than straight through, the wider clear opening is needed. No door sills should be allowed anywhere in the house.

When space is unavoidably tight, as for a closet door opening into a hall or a door to a small bathroom, consider sliding or folding doors. A sliding door may operate in an overhead track (preferred) or a recessed floor groove or both. Use only the best available hardware, for easy fingertip operation.

A folding door swings open in less space than a full door, but when open reduces the clear opening more. Preferably, it should move in an overhead track guide.

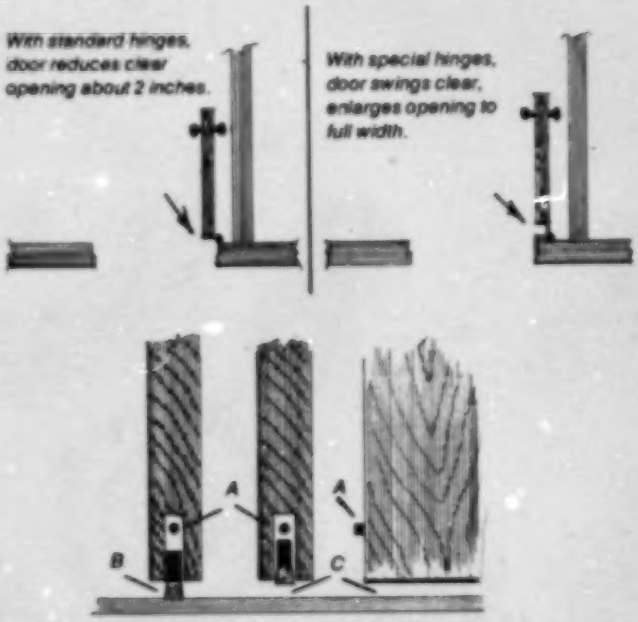
An accordion-fold door is most practical when the opening to be closed off is sufficiently wide. It takes up considerable space when folded, narrowing the clear opening.

A double-hung (swinging) door should have a see-through window so placed that the chairborne person can be aware of someone on the other side pushing the door toward him.

Doors should not be placed so as to interfere with each other when in use.

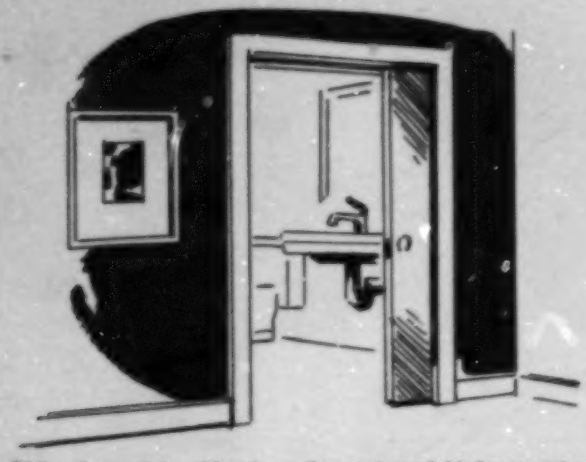
AUTOMATIC DOORS. Not commonly used at present, an electronically-actuated automatic door may be appropriate for a special situation in a wheelchair house, especially when limited upper body strength and an electric wheelchair are involved. The idea, generally, would be to control a door that should be closed at all times except for the brief interval when the chair or an ambulant person passes through.

An example could be the house-to-patio passage in an air conditioned house. The wheelchair riding onto a mat on either side of the door actuates the switch that opens the door, which remains open until the chair rides off the other mat on the far side. For the chairborne, this works best with a sliding door or, as an alternative, with the bifold type. Consult with the installation contractor on the problems of locking such a door and of manual operation in case of power failure, especially if the door must be used for an emergency exit.

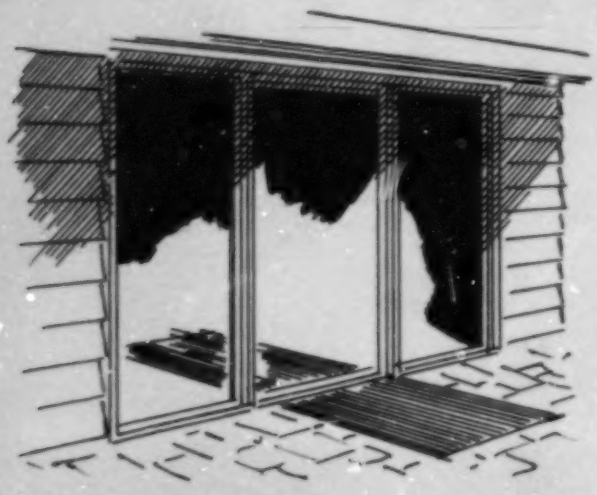

With standard hinges, door reduces clear opening about 2 inches.
With special hinges, door swings clear, enlarges opening to full width.
A
A
B
C

Instead of usual wheel-blocking door saddle and weatherstripping, this automatic door bottom permits saddle-free entrance doorway. When door is closed, movable, flexible seal is pushed firmly down against floor as plunger A is forced in by contact with plate on door frame. B shows weather seal pressed against floor. C, weather seal is pulled up by spring when door is opened and pressure on plunger removed. Device can be mortised into door bottom as shown, or is available for installation on face of door.

Folding doors can be two or more panels for average door opening or as flexible wall to partition two room areas. Available also as hollow, vinyl covered accordion fold type.



Sliding doors work well for closets if space is available for recessing into wall. Overlapping sliding doors expose only half of opening at a time. Good as room dividers. Use only finest overhead hardware, recessed floor guides.



Automatic doors, either sliding or side-hung, are actuated by riding onto electronic mats at approaches to the door.

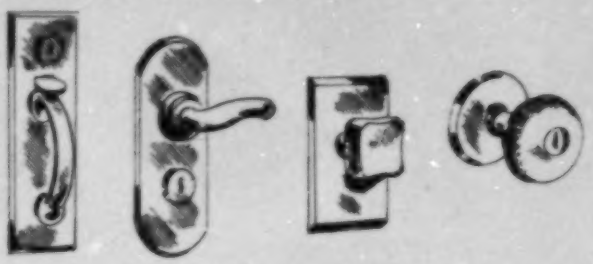
DOOR HANDLES. The best position for door knobs and handles is 36 to 38 inches high from the floor. Knobs with a rough finish are easier to grasp and turn than ones with smooth finish.

For a person with a weak or limited grasp, a horizontal lever door latch, or perhaps a vertical handle combined with a thumb-squeeze latch, may be easier to handle than a knob. Demonstration models of these can be tried out in the shop of a well-equipped locksmith. Attractive styles and finishes for residential use are available.

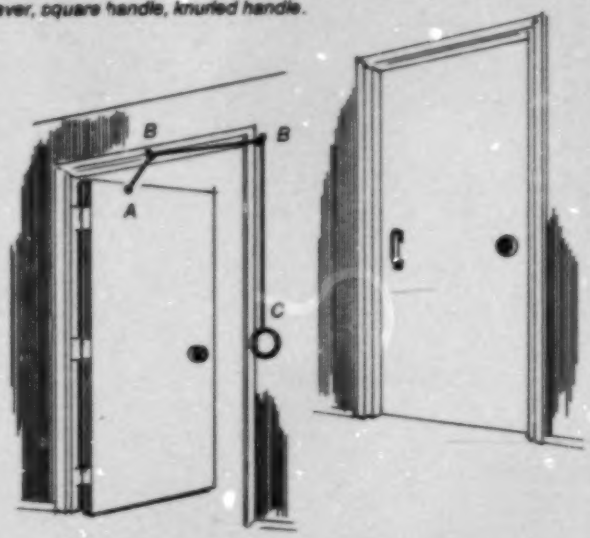
Closing a side-hung door behind one after passing through usually means: turning the wheelchair around, going back into the doorway, grasping the knob and backing up while holding it, to pull the door closed. This nuisance can be eliminated by installing a pull handle a few inches in from the hinge side, enabling the door to be closed as the wheelchair passes through. Handle height should be aligned with the doorknob.

Another device for closing a side-hung door is a sash cord pull with rings. (See illustration.)

When pneumatic door closers are necessary on interior doors they should be adjusted for very light action and to allow the door to open a full 90 degrees. The same applies to spring hinges and other closing devices.



Various types of door handles: thumb squeeze latch, horizontal lever, square handle, knurled handle.



Left, sash cord pull for closing door. A. Screw eye. B. Small pulleys. C. Curtain ring or small hoop. Right, handle on hinge side simplifies closing door as chair passes through.

COMMUNICATION

The human voice, shouting, is the simplest form of communication between a wheelchair person and someone elsewhere in the house, but this is wearing and often ineffective, if not impossible. Tapping, ringing or other noise-making devices might replace the voice, but may be even less audible.

With the use of electrically transmitted communication, a host of possibilities become available. Simplest is a bell or buzzer system with prearranged signals. (Two rings: "I need you;" three rings: "Emergency—come quickly".)

• A variety of effective electronic devices for transmitting the voice are available today at reasonable cost. Radio supply stores carrying them can be found in most communities. Applied as virtual necessities for interoffice conversations in business, such devices are used in residences to answer the doorbell, to monitor a sleeping child from another part of the house or simply as luxuries to ease room-to-room communication.

For a wheelchair person in his own home, however, an "intercom" with its many advantages is hardly a luxury. It should be included as an essential part of the house plan.

• Two important locations for a call box, obviously, are at bedside and in the bathroom. In both places the individual's lack of mobility is most pronounced. Receivers from these units should be placed in each area of the house likely to have someone present. It is also possible to run a wire to a receiver in a neighbor's house 100 to 300 feet distant.

• Common intercom models now on the market are transistorized and may be powered by battery or house current. Compact in size, they may be table-top or wall units, take very little current and can perform "alert" service 24 hours a day.

Intercom units connected directly by their own wiring system generally have better clarity of tone than those using the house electrical wiring both for power and to carry the voice signal. The latter, which are sometimes called "wireless" (not radio), have the advantage of requiring no installation other than plugging in each unit to an AC electrical outlet. Thus, a unit can readily be moved from room to room. The sound in such a system may be poor, due to annoying crackling from electrical interference. This can be avoided by the use of FM (frequency modulation) models which, while more expensive, suppress most interference and transmit voices clearly. When purchasing, be sure you are given the privilege of returning unsatisfactory equipment.

• More elaborate systems specially wired throughout the house can include selector switches for directing a call to a specific room. Installation can be by a knowledgeable home handyman or by an intercom specialist trained in the work.

A T & T. Photo

Wall phone placed at convenient wheelchair level.

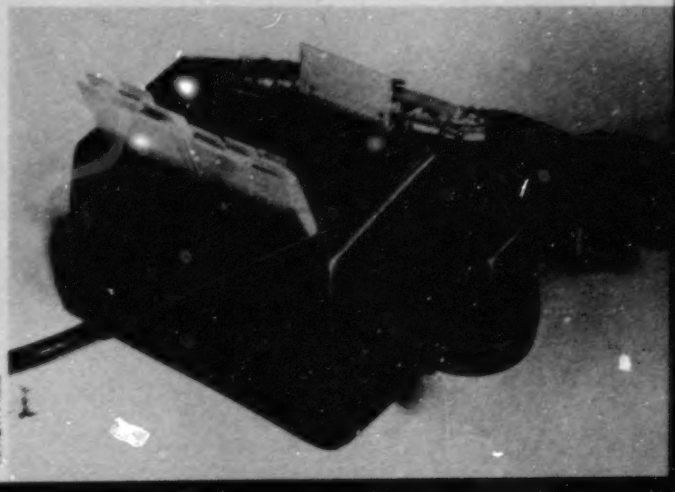
TELEPHONES

The telephone is an indispensable element in the life of a disabled person. It can enable him to do work, to participate in classroom studies from his home, to reach out to friends and the community. It also provides a measure of safety and a vital source of help to a person living alone.

In most areas the telephone company can make available devices for use of a telephone by a person with limited use of hands or arms. Possible variations that allow adjustment to the special needs of each individual include automatic dialers, hands-free equipment, connect-and-disconnect devices, push buttons instead of the rotary dial, special lightweight handsets and headsets, and many more.

Contact the local business office of the telephone company for information and a consultation on special telephone equipment for the handicapped.

Card-Dialer phone. Prepared cards stored behind instrument dial desired number when inserted as shown. Note headset jacks in near corner of instrument.



A T & T. Photo

A T & T Photo

Hands-free equipment (called "Speakerphone") for person with limited arm motion. Wooden paddles provide a wider surface and more leverage to operate on-off buttons on transmitter (near left hand in picture; speaker-receiver can be seen behind the typewriter). Touch-tone buttons to call a number (at right of typewriter) can be operated by this person with the help of a pencil

Cordless telephone and base station

Cordless telephone. In place of the usual extension cord, this telephone employs a wireless radio link between the instrument and the telephone lines. The instrument, which is portable, looks and operates like any standard extension phone. Carried freely anywhere in the house, it receives incoming calls and permits dialing outgoing calls in the usual way. The equipment consists of two parts: One is a small "base station" connected to the telephone line through a standard telephone jack. This converts incoming telephone signals to radio waves and outgoing calls, received as radio waves, to telephone signals. The second part is a similar radio capability in the portable telephone instrument, which communicates by radio waves with the base station. Not a telephone company instrument, it is available only from independent suppliers.

Lightweight headset clipped to side piece of eyeglass frame

ALARM SYSTEMS

For a wheelchair person living alone or often left alone temporarily, a sense of security can be afforded by an alarm device capable of calling for aid in the event of an emergency. This comes in various forms.

One such unit consists of a small radio transmitter in a box about the size of a cigarette package that can be carried on the person anywhere in the house. Pressing a button on the box transmits a signal to an automatic dialing device on the telephone. This then dials a consecutive series of pre-selected phone numbers, giving each a tape-recorded message that an emergency has occurred. (The principle of this system is the same as that of the widely used burglar alarms that activate automatic telephone dialers.)

FIRE ALARMS, also a vital communication need, are discussed in the section on "Safety."

CITIZEN'S-BAND (CB) RADIO

This very popular and versatile system of 2-way voice radio communication offers important advantages to the handicapped individual:

- A comparatively inexpensive means for socializing and entertainment, and particularly for summoning outside emergency help, can be had through a base station unit situated in the home. Be sure there is an adequate base station CB antenna, properly installed, for signal range and clarity.
- Communication is possible between the driver of a hand-controlled car and his home, where range permits; or with other CB operators on the road.

Frequent practice in the use of this equipment is recommended.

Left; push-button switch, responsive to a light tap of finger, replaces harder-to-work standard toggle switch. Above, thermostat, humidity control and oil burner emergency switch all within easy reach.

ELECTRICAL SYSTEM

The electrical capacity required by a wheelchair-oriented residence is essentially the same as that needed by any similar modern home. The architect or the electrical contractor will be qualified to specify whether a minimum 100-ampere, 240-volt, 3-wire service will be sufficient, or a larger service will be required to supply such major equipment as an electric range and oven, central air conditioning and an electric washer and dryer, in addition to many small appliances and adequate lighting both inside and outside the home.

Once that is decided upon, the electrical features to be considered for the chairborne person are those that enable him to safely and comfortably reach, control and enjoy the benefits of today's marvelous electrical servants.

- Each room should have a **light switch just inside the door,** to be reached easily without groping in the dark.
- All **switches placed 36 inches high on the wall** are at comfortable wheelchair level.
- **Push-button tap switches** work with only slight pressure; do not require finger strength, can be tapped with arm, elbow or wrist to turn light on and off.
- **A delayed-action switch** leaves a light on for a minute or two after it is turned off, eliminates groping in the dark.
- **Multiple-switch control** permits turning the same light on or off from either of two points: for example, at both doorways in a large room with doors some distance apart. Or from the bedside as well as from the bedroom door. Or at either end of a hallway. Or in the car shelter and just inside the house.
- Lamps, television sets and other equipment can be turned on and off by **remote controls.** One popular type is activated by a small, hand-held whistle-sounding device that can be carried on the person and operated from anywhere in the room.
- **A remote-control lighting panel** can be provided to turn lights on and off at key points inside and outside the house from one location, such as at bedside. Such a panel might include a buzzer device to open the locked front door in response to a call on the doorbell and intercom.
- In a bathroom, a **multiple-switch panel** to control lights, heater and ventilator should be within easy reach just inside the doorway.
- The fuse box or **circuit-breaker service entrance panel,** including the main switch for the entire house, should be reachable from a wheelchair. It may be inside a closet, in the garage, or in its own wall cabinet.
- **Wall outlets** should be placed 18 to 20 inches high from the floor for easy plugging in of a vacuum cleaner, lamp and so on. The outlets at a bathroom mirror, for use with an electric shaver and hair dryer, should be 36 to 40 inches high. Bathroom outlets must be well away from the tub or shower.

Plan very carefully the locations of outlets for all purposes. Most appliance and lamp cords are no more than 6 feet long, so receptacles spaced 12 feet apart will eliminate the need for extension cords.

In the **kitchen** 2 or more counter-level outlets should be on separate 20-ampere circuits to handle high-wattage appliances such as toasters, broilers, coffee pots and others that include a heating element. A frost-free refrigerator or freezer, which also uses high wattage, should be on a circuit of its own. Kitchen outlets should be within easy reach, towards or at the front of cabinets—at the mixing center, for example, where such appliances as blenders, mixers, carving knives and the like can be plugged in.

Convenience outlets in the **dining area** should be available at table height for warming trays, coffee pots and so on. It may be helpful to have one or more outlets on the roll-about serving table brought from the kitchen, which is plugged into a wall outlet in the dining area. It should be equipped with a heavy duty extension cord.

- A **battery-operated flood lamp** that goes on automatically in the event of electrical failure may be advisable. Such a unit can be plugged into the house current, which keeps the battery charged as well as conveying to it the failure signal, if necessary. This is especially appropriate in the bedroom, to assist the wheelchair resident's transfer into his chair in case of an emergency involving power loss.

WINDOWS

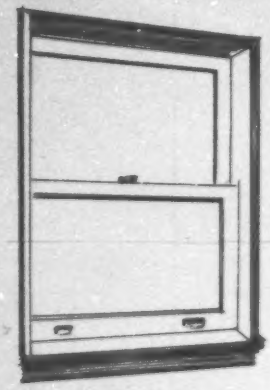
Windows, like doors, are ways of opening the outside world to the person in a wheelchair. They should offer unobstructed views, ease of opening and closing to control ventilation and ease of cleaning.

For visibility from inside to outside from a seated level, sill heights can be as low as 24 inches but should be no higher than 32 inches.

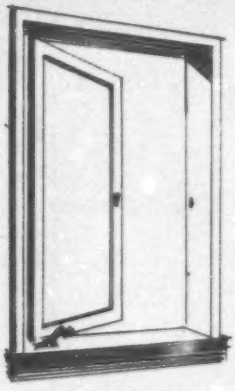
Devices to operate the windows as well as any draperies must be within easy reach of the wheelchair person. They should not be obstructed by furniture or anything else. This includes the switch operating motorized draperies.

To reduce heating fuel bills and eliminate drafts in cold climates, either storm windows or double-pane insulating glass is essential. Storm windows generally require removal and replacement with the change of seasons, a task probably beyond the capabilities of the wheelchair resident.

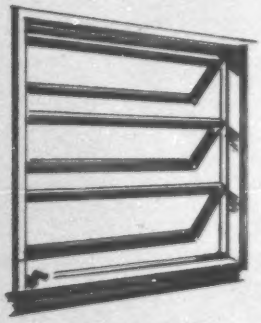
Better in this respect is double-pane insulating glass. This eliminates the need for storm windows, preventing heat loss in the winter and helping to maintain temperature control along with the air conditioning in hot weather.



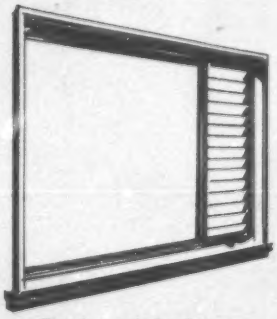
Double-hung



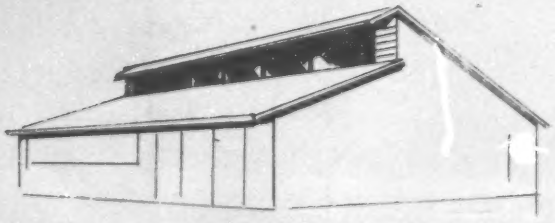
Casement



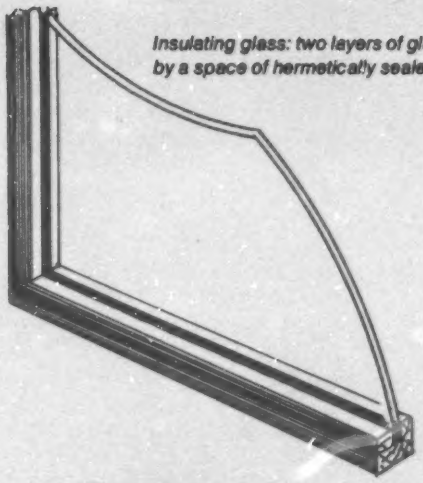
Awning type



Fixed panel plus louvers



Clerestory windows with "eyebrow"



Insulating glass: two layers of glass separated by a space of hermetically sealed dry air.

TYPES OF WINDOWS

The common **double-hung windows** (the kind with two halves that slide up and down), even when new and properly installed, are, to say the least, difficult for a person in a wheelchair to operate. Pushing the lower pane up and down may be possible with strong arms, but the upper pane is probably out of reach, unless operated with a pole as in some old commercial buildings. If the usual unreachable latch at the top of the lower sash is closed, the lower pane will be immovable without help.

The side-hung full or partial **casement window** that opens outward generally has an easily-operated control, usually a crank on the sill. A type of casement hinge hardware exists that not only swings the window open but moves the hinged edge away from the wall; the outer surface of the pane is then reachable for cleaning from inside.

Awning-type windows, in which the lower edge of one or several horizontal sections swings outward, help shield the interior from rain when open. Inside screening is customary on all types of windows that open outward. High-up transom-type windows may be installed above a large, fixed pane. Or they may be the only openings, meant solely for ventilation and light in a bedroom with otherwise solid walls for privacy. In either case, they must have provision for remote control at a reachable level.

Openable **clerestory windows** (set in a wall that reaches above the adjacent roof) and skylights can also be operated manually by remote control or electrically by switch-controlled devices.

Sliding windows must move smoothly and easily, controlled from one point that is easy for a wheelchair to reach.

If the wheelchair resident is to clean windows, they should be a tilt-in or other type that makes it possible to reach both sides of the glass from the inside, unless it is possible to do the job from outside with long-handled equipment.

A bathroom window should never be placed above the tub, where it will create drafts and be hard to reach for operating and cleaning.

Window walls, judiciously placed to open a room to a beautiful view or a private patio, can add a pleasing dimension to the house. But avoid so-called picture windows that frame only an undesirable outlook such as street traffic, while exposing the interior to loss of privacy.

ELEVATORS AND CHAIR LIFTS

Contrary to what one would expect, there may be a definite need for an elevator or chair lift in a one-level house built or adapted for wheelchair living. A large majority of American private homes include basements, and the same applies to wheelchair houses. In effect, then, a one-level home becomes two-level if the basement can include inducements to use by the chairborne individual.

Or perhaps a growing family requires additional sleeping quarters, and an unfinished attic is the only space available to be converted to that use. If wheelchair accessibility is essential, a lift of one kind or another could provide a solution more satisfactory than other options.

There are three basic types of residential elevators to suit the needs of the chairborne: the vertical elevator, the stairway wheelchair elevator, and the stairway chair lift. Each is available from manufacturers whose representatives will survey the location in the home and then custom fit and install the equipment.

The **stairway chair lift** (not to be confused with the stairway *wheelchair* lift) has many limitations for the average wheelchair person, but it is being used successfully by some PVA members. Independent use of the device, without assistance, requires upper body and arm strength, including the *ability to transfer safely* from wheelchair to lift chair, and back to *another* wheelchair at the top or bottom of the stairway. Thus, it actually calls for *two* wheelchairs, one at each landing, and each must remain within reach at all times.

The passenger controls movement up or down with a button on the chair, which stops automatically at the top and bottom of the stairway. The lift can also be operated remotely by control buttons at the top and bottom of the stairs.

For other than a straight stairway, such as one with a curve, or with a midway landing and change of direction, a type of chairlift is available that can be adjusted to solve the problem. However, the cost of such an installation may warrant consideration of a vertical elevator.

Wheelchair Stair Lift

The **stairway wheelchair elevator** or lift is a mobile platform designed to carry the chairborne occupant and his chair safely up and down a straight stairway. Fingertouch operating controls on the lift should be easily reached by the passenger. Limit switches should stop the platform automatically at top and bottom landings. Remote control buttons to call the lift to the desired landing must be located at both ends of the stairway.

Safety devices should be included to prevent the wheelchair from rolling off during operation; to lower the lift gently in case of power failure or failure of the drive mechanism during transit; and to stop the motion of the lift instantaneously should any obstruction be touched on the way up or down. A stairway at least 34 inches wide is needed, with adequate space for landing the platform at the lower level.

A

B

Stairway chair lift: A. User transfers to lift chair at top of stairs. Seat cushion contributes to comfort of those susceptible to skin damage. B. Lift chair swivels completely around to begin descent. C. Transfer to wheelchair at bottom of stairs. D. Basement workshop, reason for the chair lift.

A shaft enclosure for a **vertical elevator** can be planned for any appropriate location in the house. Direct accessibility is essential at both floor levels. Car floor dimensions for the average 42-inch-long wheelchair (plus the occupant's shoes projecting beyond the footrests) must be a minimum of 4 feet from inside of door to the rear wall, and 3 feet wide. Of course, the inside dimensions of the shaft will be somewhat larger, to accommodate the car and guide rails.

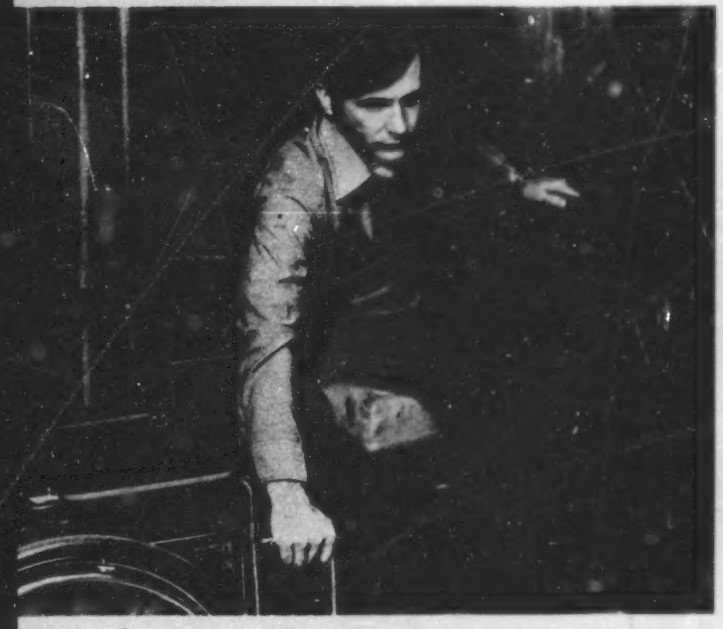
Power units can be installed in any of a number of locations. Safety interlocks should be installed to prevent operation of the elevator unless all doors are closed, and to prevent opening of a shaft door except when the car is at the door. Call buttons at each level and control buttons in the car, located 36 inches high, will be reachable from a chair.

The chair should be backed into the elevator, with the occupant facing the door. Control buttons should be on the right or left wall to suit the strength and comfort of the individual. In a situation where approaches at the two levels are from different directions, however, the car should be equipped with doors at both sides. Again, control buttons should be planned for the most convenient reach of the individual, whichever way he enters.

Open platform elevators for short vertical lifts, up to a maximum of 5 feet, are available. These are applicable to indoor or outdoor use and can usually be installed with very little additional construction expense. This type of unit may handle a problem situation that is not readily adaptable to ramping. See illustration, page 7.

Power for all the units described may be supplied by ordinary house current and will add almost nothing to the monthly electric bill. But cost of purchase and installation of the equipment is substantial, with the vertical floor-to-floor elevator in a shaft generally the most expensive. However, any of these units may qualify as a medical deduction for federal tax purposes.

Home elevators are built and installed by reliable commercial firms with consideration for safety as well as convenience. Elevators can also be custom-built, provided they can be engineered with the same care and efficiency. The elevator pictured was designed and built by a local engineer, who also services it regularly. Safety devices include doors that can be opened only by a key, and then only when the car is at door level; also, limit switches that stop the car automatically at the two landings. "Up" and "Down" buttons inside move the car only when pressure on them continues; when pressure is removed the car stops at once.



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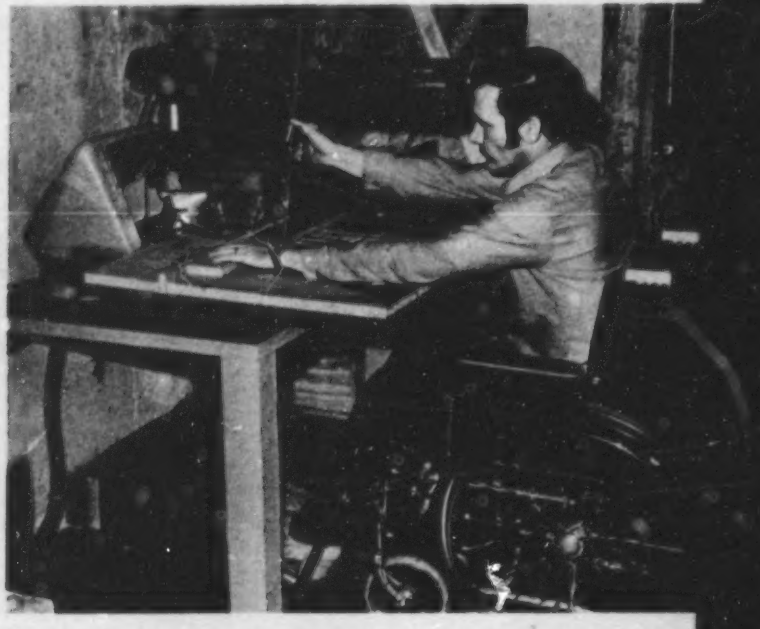

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CI 16

THE KITCHEN

In a wheelchair house the kitchen, with its expensive appliances and custom cabinetry, may well be the costliest room of all. Careful planning is essential, if only to avoid having to redo it all because of errors that place hurdles in the way of effective use by a handicapped homemaker.

The wheelchair resident may not expect to be involved with kitchen activities. In that case, its design can be geared toward wheelchair accessibility for meals and social, rather than working, purposes—with perhaps some concession to the possibility of occasional meal preparation. When use will probably be limited to reaching for a glass of water or other casual refreshment, the kitchen can be designed for the able-bodied worker (using standard rather than custom-built cabinetry, for example) with some minor wheelchair-oriented modifications.

The suggestions that follow, however, are aimed at creating a functional, attractive and cheerful kitchen for the chairborne homemaker—the person who will use it many hours every day for preparing, serving and cleaning up after meals. This section provides general guidelines for planning and design of a wheelchair kitchen; more detailed development of these suggestions may be found in "The Wheelchair in the Kitchen," published by the Paralyzed Veterans of America.

GENERAL

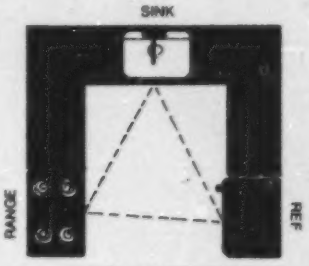
- Easy accessibility: Doorways should have at least 34-inch clear openings. Direct, level entrance from an outside delivery door and the car shelter are advisable.
- No door sills that might be bumped over with a load of hot food.
- Adequate space for the chair to maneuver, including complete turns in any direction.
- Floor must be absolutely level so braking is not constantly needed at work centers to keep chair from rolling.
- A triangular work-center plan: refrigerator to sink to range, with adequate counter space next to each.
- Natural ventilation and an exhaust fan to remove airborne cooking grease, steam and heat.
- Pleasant, well-lit working conditions; cheerful color and overall decor to reflect the personality of the homemaker.

WORK SURFACES

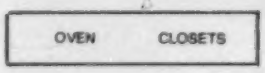
- Countertops, sink and range at comfortable working height for the seated person; that is, no more than 32 (preferably 31) inches instead of the standard 36 inches. Counter surfaces continuous and at one level to form a freeway on which filled pots and other burdens can be slid from place to place instead of carried.
- Mixing work center: 27 inches high, with knee space beneath. Can be pullout shelf, drop-leaf table, built-in or perhaps roll-out mixing center.
- Adequate electrical outlets for small appliances, at front of base cabinets, especially near mixing center.
- Roll-about serving table (may be built-in for storage under a counter) to serve an entire meal safely in one trip and for help in after-meal clean-up. When an under-counter roll-out table is out of its place, the counter above it can serve as a mixing center, with plentiful knee space below.

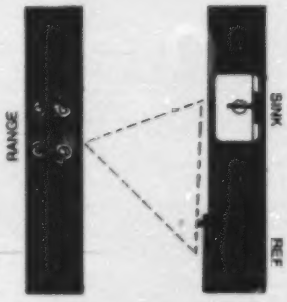
REFRIGERATOR-FREEZER

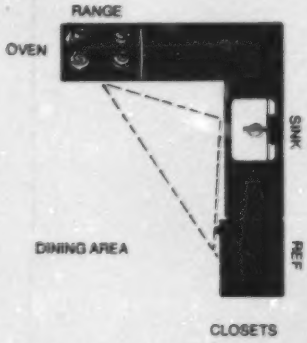
- Plan only a 2-door model, not a one-door with a freezer section as a compartment inside. Freezer section should be large, and capable of maintaining 0° F. to keep foods safely frozen solid, in order to permit maximum storage and reduce shopping trips.
- Both refrigerator and freezer compartments should be frost-free to eliminate difficult and time-consuming defrosting chore.
- A freezer compartment at top should have side-opening door to facilitate reaching in. Avoid too-high top freezer, making food in rear inaccessible. Consider a side-by-side (French-door) type refrigerator-freezer combination, or pullout drawer-type freezer at bottom.
- Look for slide-out or rotating shelves. Or install shallow turntables, available from most houseware stores, on each shelf to bring food stored at rear within reach.
- For special convenience: automatic ice cube maker inside freezer or chilled water and ice cube dispensers on outside of door of freezer compartment, available in some side-by-side models (requires plumbing connection).
- Provide counter space on open-door side of refrigerator for easy transfer of food.



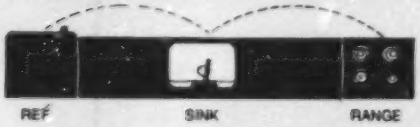
Left, U-shaped kitchen, triangular work center plan, continuous counters. Locate wall oven, storage, on extension of one or both legs. L-shape, below, also offers continuous counters. Good basic plan for many variations.







Corridor, left, needs 5-foot turning space between counters. Bridge them with roll-table or tray. Below, one-wall or studio plan is least efficient for wheelchair use.



SINK

- Should be easy-to-clean stainless steel, no more than 5 inches deep, sunk into the 31- or 32-inch high counter. 5 inch depth is easier to reach into and provides ample knee and lap space beneath (facilitated by desk-type recessed armrests on the wheelchair). Double sink, if space permits—but not needed if a dishwasher is planned.
- Underside of sink, hot water pipes and drain pipes insulated to prevent burns.
- Drain or garbage disposal unit at rear, preferably a rear corner, to keep knee-space open.
- Retractable spray hose has many valuable uses, especially filling pots on the counter, eliminating need to lift filled pot out of sink.
- Easily-handled water controls; preferably a one-handle faucet.

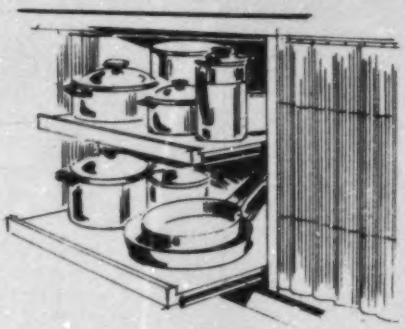
DISHWASHER

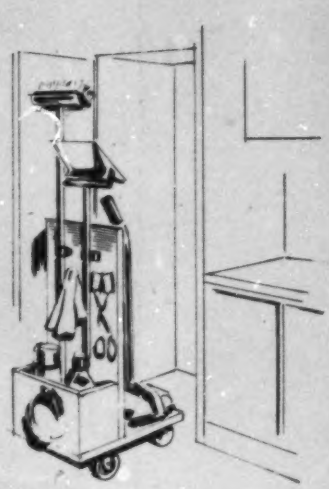
- Front-loading, under-the-counter unit installed close to sink—a *must* in the chairborne homemaker's kitchen. Can save hours of tedious work daily; does a much better job than hand washing.
- Because of height of all such units now available, will probably have to be at end of continuous slide-along counter surface, perhaps next to refrigerator.

COOKING CENTER

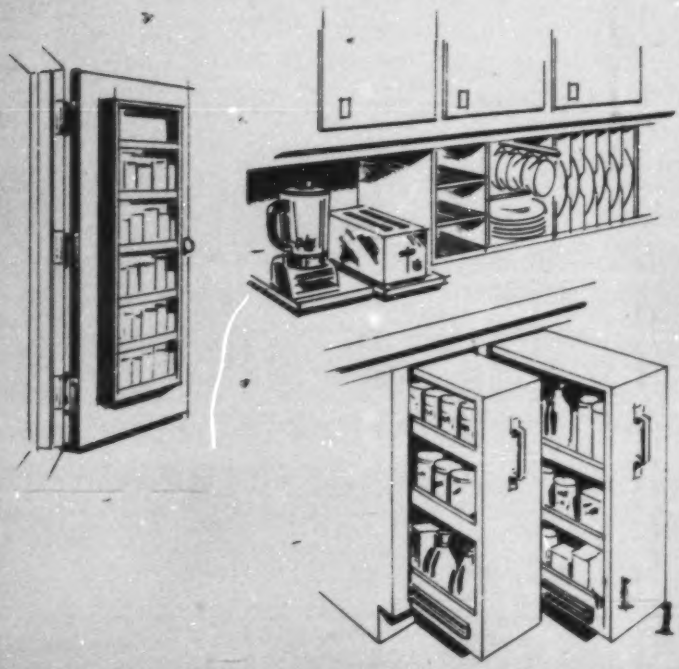
- Gas or electric surface cooktop unit set into wheelchair work-height counter is preferable, with knee space beneath.
- Controls in front for easy access without reaching over hot burners and utensils. Second choice: controls on side. (Push-button type controls available in electric ranges may be an advantage for some.)
- Similarly, staggered burner arrangement for safe access to pots on rear burners.
- OVEN: wall-type, installed at height convenient to user, preferably with most-used shelf on level with adjacent counter. Heat-resistant counter surface or pullout shelf alongside for placing hot utensils removed from oven. Side-opening door for easy reach-in, easy cleaning. Self-cleaning type is advisable. (Consider microwave oven, which greatly reduces cooking and clean-up time.)

Right, base cabinet glide-out shelves make heavy items safely reachable. Bamboo curtains are colorful, need no wheelchair maneuvering. Far right, homemade wheeled cleaning cart; nature of homemaker's disability has to be considered in design.





Below, left, canned food storage mounted on closet door. Right, frequently used dishes and appliances conveniently stored in back-of-counter racks. Package food storage in base cabinet may be helpful in limited upward reach.



KITCHEN STORAGE

- All utensils, foods and condiments, cleaning supplies, and so on, within easy reach, preferably at points of their first use.
- All base cabinets custom-built to the required height for wheelchair use. Provide toe space for closer approach. Use smooth-gliding drawer hardware, tap catches for feathertouch door openers.
- Wall cabinets standard, but lowered to place items on lower shelves within reach.
- Use space between wall cabinet and rear of countertop for easy access to items in frequent use.
- Pegboard on wall space for miscellaneous items.
- Heavy items and breakables stored low. Use reachers for light packages and plastic items stored above.
- Broom closet with roll-about cleaning caddy.

EXERCISE AREA

The health and sense of well-being of a chairborne individual are improved by physical activity and exercise, whether self-motivated and administered or applied with the aid of a physical therapist. The person with a strong upper body can achieve a large part of his or her daily exercise while seated in the wheelchair itself, partly by the normal activities of daily living and partly by simple calisthenics such as push-ups from the seat, weight-lifting, bending, flexing, twisting and isometrics.

Additional setting-up exercises can be done on a bed, either alone or with the aid of a physical therapist. The individual with limitations of upper-body strength must have the assistance of a physical therapist or other trained aide.

Where possible, an exercise area set aside exclusively for the purpose is recommended for the person who needs or desires the use of specialized, space-consuming apparatus for arm development, weight-bearing (standing) or other such activities. A spare room at least 10 feet by 10 feet will serve the purpose, if properly planned.

Wall-hung upper-body and arm exercisers take almost no wall space, but do require floor space in front and to the sides, for the chair and for wide arm movements. Parallel bars must be approachable by the chair, a maneuver that in itself takes over 4 feet, so the length of the bars can hardly be more than 5 to 6 feet. A floor mat may be attached to a hinged board, which can be folded up to a wall and out of the way when not in use.

Planning a room for convenient use will encourage the urge to exercise. In addition, such a room may be the ideal place to store such other frequently used items as a shower chair or an electric wheelchair.

THE LAUNDRY

For the chairborne homemaker, having laundry facilities close to the kitchen is a practical way of coordinating several time-consuming activities with a minimum of movement from place to place.

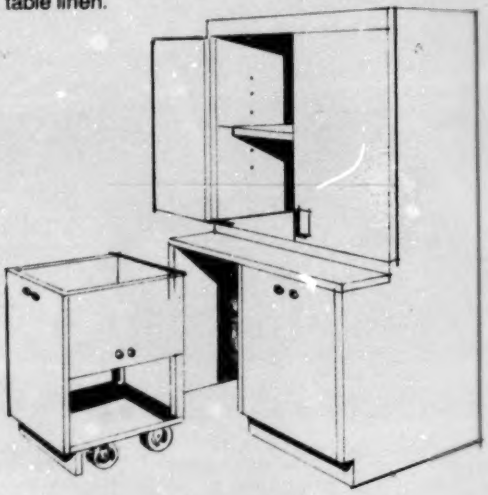
The basic necessities are an efficient automatic washer, a dryer, storage space for supplies, a good lightweight steam iron, and an adjustable ironing board that can be set at a comfortable seated-work height of about 29 inches. The board should also be capable of changing to a standing-work height for the convenience of others who may wish to use it.

Soiled laundry storage in the same area is a convenience, but if space is at a premium it may be found closer to the bedrooms and bathrooms where most soiled linen originates. Roll-about hampers are then needed for easy carting of materials to and from the laundry machines.

Look for a front-loading drum type of washer, which may be difficult to find but is available. It is more accessible than the usual top loader; this is too high and its tub too deep for the average wheelchair homemaker.

Most automatic dryers are designed as front loaders. Select a model with controls up front and within reach.

If the laundry area has adequate space, consider the possible value of an electric roller type of ironer. But do not overlook that boon of modern textile science, "permanent press". This invention has taken the labor of ironing out of a large percentage of our everyday clothing, as well as bed and table linen.



Closet with hanger-rod at reachable height. Note chest of drawers in wall recess to provide obstacle-free wheelchair movement.

STORAGE

Household storage space, for the chairborne, is essentially closet space. Attic and basement storage, as well as most shelf space higher than a seated person can easily reach, is usually physically off limits. A certain amount of household storage involves seasonal items and things for which there is only occasional use. Such things can be relegated to the unreachable spaces, provided that they can be placed there and retrieved by others in the family as required. It must be considered and accepted that most wheelchair people who live in one-family homes cannot do so alone.

Things in active use regularly and daily, in every area of the house, must be within comfortable reach of the wheelchair resident if he or she is to function independently without frustration.

Planning wheelchair-accessible storage calls for ingenuity. It involves, first, appropriate location of the storage space. Then, doors and drawers must open and close with little effort, not act as barriers to the reaching hand. Here the secret lies in selection of appropriate hardware of the finest quality.

Examples are: kitchen cabinet doors, without door pulls, that open by a light tap on the door surface and close just as effortlessly. Also, drawers that open at a finger touch, no matter how heavily laden, and close when gently nudged, literally pulling away and closing themselves two or three inches before complete closure. Also, clothes closets with smoothly moving sliding doors and low, reachable hanger poles. A wheelchair does not need maneuvering around a sliding door as it does for a side-hung door. But if a side-hung door must be used, it should be capable of opening a full 180 degrees, to permit unobstructed access for the chair.

The popular walk-in type of closet is particularly well adapted to wheelchair use for clothing and other storage needs. There should be adequate space, however, for reasonable wheelchair maneuvering at the clothes racks or shelves, as well as easy access and egress. A standard side-hung door may be most appropriate for this use.

For storage of packaged food, cleaning supplies or cooking utensils, a broom closet-sized cupboard with a vertical center pole around which circular shelves revolve can present items directly to the chairborne person's reach at heights that would make them unreachable at the rear of ordinary fixed shelves.

FLOORS AND FLOOR COVERINGS

For a wheelchair, wooden or tile flooring is preferable to carpeting. The chair moves easily on firm flooring, but is much more difficult to propel over carpet pile. Smooth and well-maintained woods or tiles are attractive; they can be kept so by the occasional application of a non-skid polish.

If carpeting must be used, a very low, dense pile should be chosen, in carpet of a tough fiber such as nylon, of the kind generally used in commercial establishments. Avoid deep piles and shags. A test should be made before buying by rolling a wheelchair over a large sample piece in the store. If the pile drags at the wheels or mats down and shows tracks, it is not suitable. The indoor-outdoor type of carpeting might do—provided it passes an actual wheelchair test.

When laid, carpeting should be tightly stretched in a wall-to-wall installation. Any exposed edge may present an obstruction to a chair.

Scatter rugs and larger area rugs should not be used unless they can be firmly anchored to the floor. This may be possible with a good grade of double-faced adhesive tape. Otherwise, loose rugs are likely to be clutched at, pulled out of place and lumped up by the swiveling action of the wheelchair's small casters—a source of continual irritation and frustration to the chairborne individual.

Above, chair rides under wash basin in commercially-available wall-hung countertop. Note height of two medicine chests with sliding mirror doors and overhead lights above the double basins, set for use by both chairborne and standing persons. Faucet controls are single handle type. Below, custom-built vanity with wash basin at comfortable wheelchair height. Large mirror covers wall. Supply cabinet (partly visible) is beneath the counter at right.

Standard wall-hung wash basin is sat at wheelchair height, has single-knob faucet control. Sturdy, solidly mounted grab bar over tub helps in transfer from wheelchair into tub for bath or hand-held shower use. Footrests removed from chair, or turned back, brings chair close to tub for easier transfer. Cushion in tub (not shown) is recommended. For these maneuvers, strong arms are essential.

THE BATHROOM

Chiefly for reasons of economy, no doubt, it is a longstanding American practice to make bathrooms small, crowded and inconvenient even for people who are fully ambulant. Such a room may be totally unusable for a chairborne person.

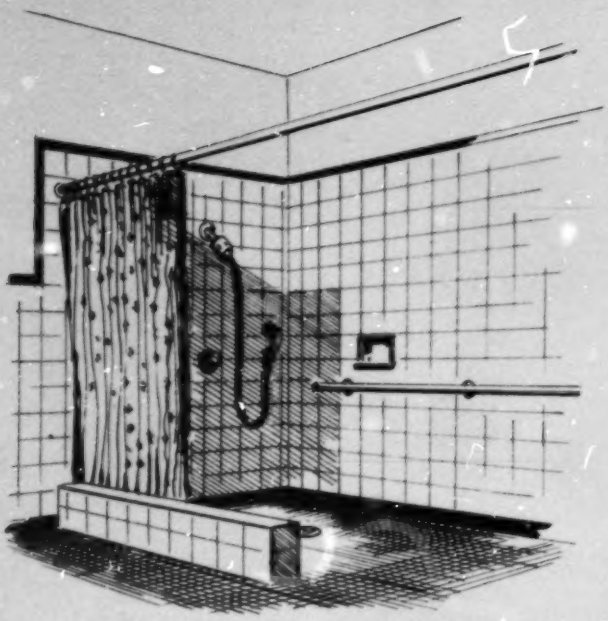
Designing an adequate bathroom needs careful and thoughtful planning. Any barrier to its convenient use can be an emotional and health problem to the wheelchair resident, as well as creating unnecessary dependence on others. The bathroom should be *more* than adequate. A room of minimum size, carefully planned to admit a wheelchair and serve its occupant's needs, might do. But generous size combined with well-selected and properly placed facilities will create an atmosphere of comfort and convenience in a psychologically sensitive area; this can give dividends in morale and self-sufficiency.

Size in itself is probably the most beneficial feature of a wheelchair bathroom. It should be sufficient for easy entering, turning and maneuvering of the chair. Ideally, the chairborne individual should be able to wheel in, close the door, approach any of the facilities with ease, use them comfortably, and turn to wheel out without backing up.

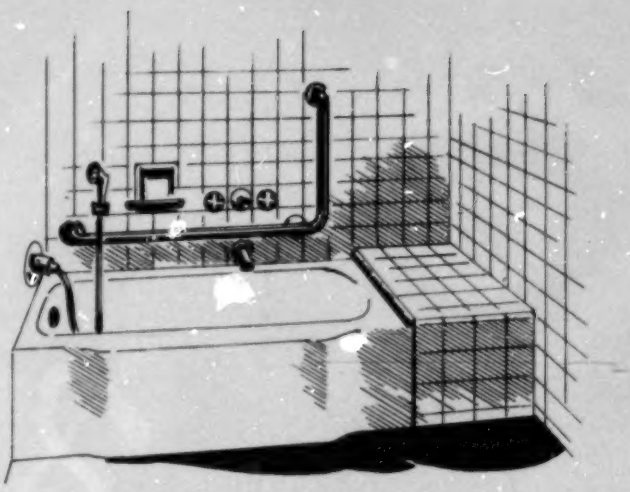
Accessibility is the first consideration in planning the use of the space allotted. The door should be approachable directly, without obstructions and preferably without need for a turn. A 34-inch clear opening is recommended, but it cannot be less than 32 inches.

If space does not permit closing an inward-opening door with the chair inside, the door can be reversed to open outward. Such a door should have a handhold close to the hinge for pulling it shut from inside. For safety, an outward-opening door may be preferable even if the space is adequate. Should an emergency arise needing outside aid, an inward-opening door might be blocked by the chair itself from being opened from the outside.

The bathroom door might be the double-hung type, opening in either direction (again, a handhold near the hinge is desirable); or the accordion type; or a folding one. A sliding door is probably the most efficient. The door sill should be shallow or absent completely.



Tub space converted to wheelchair shower.



Seat built outside tub, with grab bar and reachable water controls, to facilitate transfer from and to wheelchair.

Facilities. The purpose of a bathroom is, of course, to make possible two things: elimination of body wastes and maintenance of body cleanliness. The first requires an accessible toilet commode. The second calls for a wash basin, plus a shower or tub or both—possibly in a two-in-one combination.

The various types of equipment available, including a French-style bidet for water cleanliness after toilet use and for feminine hygiene, are discussed in considerable detail in "The Wheelchair Bathroom," published by the Paralyzed Veterans of America. This should be consulted.

The wheelchair user of the facilities may have preferences determined by the nature of his disability and the strength of his arms and upper body. Adaptive equipment can be installed, such as support bars, an overhead trapeze to enable him to lift himself by one or both arms, a bathtub lift device, or a built-in seat outside of and at one end of the tub.

The tub's upper edge should be flat, not rounded. Removable wheelchair armrests and in some instances removable footrests may facilitate movement from chair to tub.

Shower. For the person who prefers a shower, a stall model may be more practical than the shower in the tub.

A roll-in stall shower, about 4 feet by 4 feet (inside dimensions) is ideal. A special wheelchair may be used—perhaps an old one adapted by lacquering or painting to make it reasonably rustproof, with seat and back of canvas or other waterproof material and perhaps with a cutout seat to permit cleansing of the lower body. A hand-held "telephone"-type shower fixture on a flexible hose greatly eases showering.

Instead of the usual high sill at the stall entrance to prevent overflow, it should be very low or absent, replaced with a slight grade toward the drain. An extra-long curtain that rests 2 or 3 inches on the floor will help control splashing and overflow.

A shower stall too small to accept the wheelchair can be used if the minimum inside dimensions are 3 feet by 3 feet. A smooth, softly padded bench may be situated inside the stall. Space in front of the stall should be adequate for a head-on approach by the wheelchair with footrests removed to facilitate transfer to the seat inside. Or a side-of-chair transfer with an armrest removed may work. A sturdy grab bar inside the stall will aid in the transfer and for balance while showering.

Special commode-like shower chairs to fit into the smaller shower stall are available, but may require the help of an attendant.

Where a tub already exists, it may be converted to a wheelchair shower by removing it and using its space and plumbing connections to install a shower fixture and floor drain at one end of the vacated area. The floor, when waterproofed and tiled, should slope slightly toward the drain. The room wall should be tiled several feet high on three sides of the area. A low tiled partition (1 or 1½ feet high) can be built on the fourth side, extending about halfway out from the wall at the shower-drain end. The other half should be left open for a roll-in entranceway. Curtains or sliding plastic walls above the partition and extra-long curtains over the entranceway will control splashing.

Note: Only a small commode-type shower chair will fit the available space. Solidly installed, well-placed handrails can help in maneuvering the chair into and out of the shower. To accommodate a standard, hand-propelled wheelchair, eliminate the low partition on the fourth side.

Toilet. The toilet should have maneuvering space beside it for sideways movement from wheelchair to seat. Again, removable chair arms and perhaps footrests may be helpful. A toilet placed close enough to the wash basin will permit anal cleaning with water after toilet use. Placed alongside the tub, the toilet seat may be used as a bench for transfer to the tub and for drying after the bath. Strong, well-secured grab bars, tailored to the needs of the wheelchair person, may be advisable.

Basin. The wash basin should be wall-hung, without a pedestal or corner legs, unless the legs are far enough apart and the underside of the basin high enough to permit a wheelchair underneath. An excellent solution is a countertop

vanity into which the basin has been recessed. Proper knee space beneath should be tailored to the individual.

Mirror. A large mirror, installed over the basin low enough for comfortable use at wheelchair level, is important for ease in grooming.

Controls. Equip the wash basin, shower and bathtub with easily handled water controls. The wash-basin faucet, for example, might be the one-lever type, with which temperature is set by movement from side to side, volume by up or down. This permits setting the desired temperature before the volume is turned on.

Safety. Both shower head and bathtub faucet must be equipped with a protective temperature-sensitive device that prevents excessively hot water from reaching the bather.

Protect exposed hot water and steam pipes in the bathroom with asbestos or other insulation. Contact with heat by body areas that are without sensation can do serious damage. Even when he feels it, a handicapped person may not be able to recoil quickly from a hot surface.

Never install electric outlets or switches where they could be reached by a person in the bathtub or shower.

Other Conveniences. Cabinet space should be adequate, within reach and well planned, taking into account how often and when the stored items are used. For example, one cabinet should be reachable from a seated position on the toilet. Also, a hook on the wall between the wash basin and toilet may make possible the unaided use of enema equipment.

Another convenience is an auxiliary heating device, installed in the wall or ceiling and controllable by a switch at the room entrance.

For someone who requires assistance in using the bathroom facilities, space must be provided for the attendant to maneuver. It should not be necessary to remove the wheelchair from the room to enable the attendant to assist with an enema, use a bathtub transfer lift or give other services.

Finally, avoid clutter in the bathroom. Keep aids and equipment for both the wheelchair person and others to a necessary minimum. Also hold down the materials customarily stored in the bathroom. Make the room an attractive place as well as a convenient one.

Left, stall shower built to accommodate occupant-propelled wheelchair. Chair should be waterproofed (chair in picture is not) and have cut-out seat for underbody cleaning. Center, tub adapted for showering, with strong grab bar and portable seat. Shower mechanism permits testing temperature of water through tub faucets before turning on shower. Right, completely waterproofed bathroom with drain in tiled floor. Chairborne resident requires help for showering, made easier in spacious, unconfined area. Note small washer-dryer for towels, washcloths.

Grab bar at toilet, needed for transfer from wheelchair and to maintain balance when seated. Space around toilet for close approach of chair.

THE BEDROOM

The size requirements of a bedroom may vary considerably, depending on the furnishings that must go into it. A single bed, either twin size (39 by 75 inches) or hospital-type, can fit into a room that is 14 by 11½ feet. This will allow adequate wheelchair mobility and transfer, provided, of course, that the room is not cluttered with excess furniture.

If two twin beds are involved, they may be spaced apart so that a wheelchair homemaker can get around and between them in making them up and cleaning. For this, the minimum space required is considerably greater, as much as 20 by 11½ feet. Pushing the beds together to make a close-to-kingsize (78 inches wide) unit can reduce the needed room length to about 17 feet. These are minimums; as always, the luxury of extra space wherever possible makes for more comfortable wheelchair living.

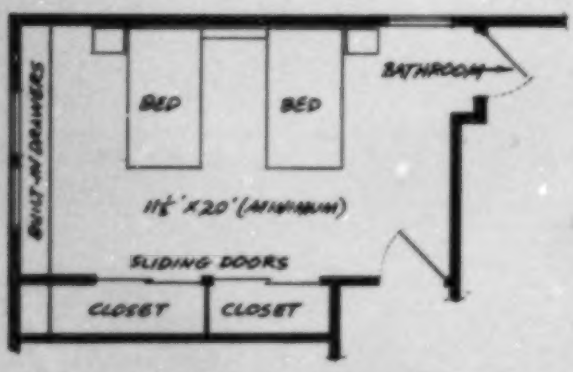
If possible, avoid positioning the head of a bed against an outside wall, unless the wall is exceptionally well insulated. *Never* place the head of a bed against a window.

Arrange furniture so as not to create an obstacle course for the wheelchair, especially if it must sometimes move around in the dark.

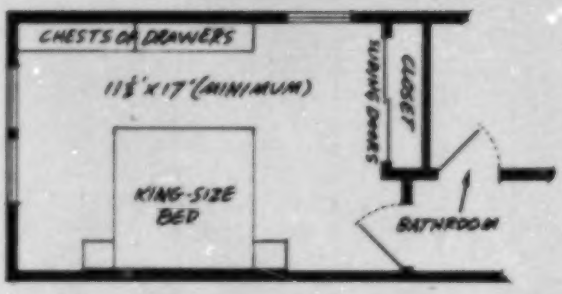
Bedroom planning should include direct and clear passageway to an adequate bathroom, preferably within the privacy of the bedroom.

The bedroom should have adequate and accessible electrical outlets for all appliances likely to be used there. These might include such easily overlooked things as the charger for an electric wheelchair or an electrically operated adjustable bed, as well as a vaporizer, television, radio, phonograph and other personal items.

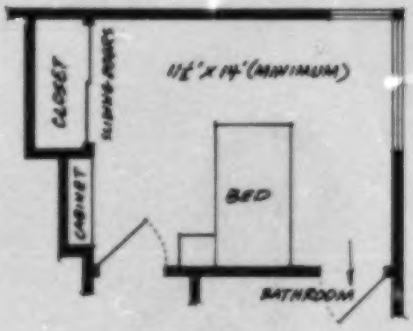
Selecting the appropriate spot for an intercom may need thought. Also, the possible need for remote control switches at bedside for certain house lights. Then there is the right place for the telephone and possibly for a Citizen's-Band base station transceiver. Organizing any such needs into a comprehensive package is easier when the planning is done in advance, along with the positioning of the bed.



Twin beds spaced apart for wheelchair access between. Keep furniture out of wheelchair path.



Twin beds together, or king-size bed, need less space.



Single bed, or hospital type, needs least space.

THE GOAL IS MOBILITY

Eliminate dead ends. These three words are the key to a wheelchair house principle that goes a step beyond the conventional open floor plan. It offers the ultimate in freedom of motion to the chairborne person while providing practical convenience to the rest of the family, especially to the homemaker, by cutting mileage out of the daily chores.

We call this principle **the circulating house.** It describes any floor plan for a one-level house designed so that one can circle the interior and visit all the most actively used rooms without backtracking. Each room that is part of the circuit must be approachable from either of two directions. Though the concept does not necessarily include bedrooms and bathrooms, even they could be included if desired.

Many wheelchair homes have been designed for open circulation because the concept is so practical and logical. Where a tract developer is constructing a number of homes in an area, one of his plans may be convertible to a circulating house by simply opening one new passageway, provided, of course, that all other requirements for accessibility are met.

A hallway in a wheelchair home should not be less than 4½ feet wide for comfortable maneuvering at closets and doorways and for easy, about-face turns. But with building costs rocketing from year to year, halls are an expensive luxury and, in most budgets, must be kept to a minimum. A hall leading from the entranceway, however, can be one end of the circulating plan, and will serve both functional and esthetic purposes in the overall design.

The chairborne resident should not face the frustration of being barred from any part of the house: all rooms should be accessible, even those that might be visited only rarely. Often the difference in welcome or no welcome is made by the furnishings and their placement in a small room. In a child's room, for example, situating the bed against a far wall will leave space for a visiting wheelchair, while the same bed placed in the center of the room would make visits difficult or impossible. Small rooms, their windows and closets should be planned with wheelchair access in mind; this is especially important if the chairborne person is the homemaker and a parent of small children.

A 4½-foot-wide hallway makes possible turns in any direction.

Three demonstration house plans are illustrated. These point up a few of the many possible specific features of a wheelchair-conscious design. Each of the three belongs to a member of PVA and has been proved in service over years. House Number One was built on problem land that, on first consideration, was deemed inappropriate for wheelchair accessibility. Such an exception to the rule calling for level terrain demonstrates that creative designing is possible, that the ingenuity of a resourceful architect backed by a daring owner can compensate for various problems.

DEMONSTRATION HOUSE NUMBER ONE

This house, built around a central plumbing core, permits total wheelchair circulation. Except for the bathrooms, every room is accessible from more than one direction. Though not large (1500 square feet exclusive of the basement), the house has an entrance foyer and hallway wide enough for turnaround wheelchair maneuvering. A two-car carport shields the front entrance, which is approached by a ramp graded slightly upward.

The spacious living room and the owner's wheelchair bedroom look out onto a fully accessible cantilevered balcony and a woodland view, the living room through a glass wall and double glass doors, the bedroom through wide windows and one door. A large bathroom adjoins the bedroom.

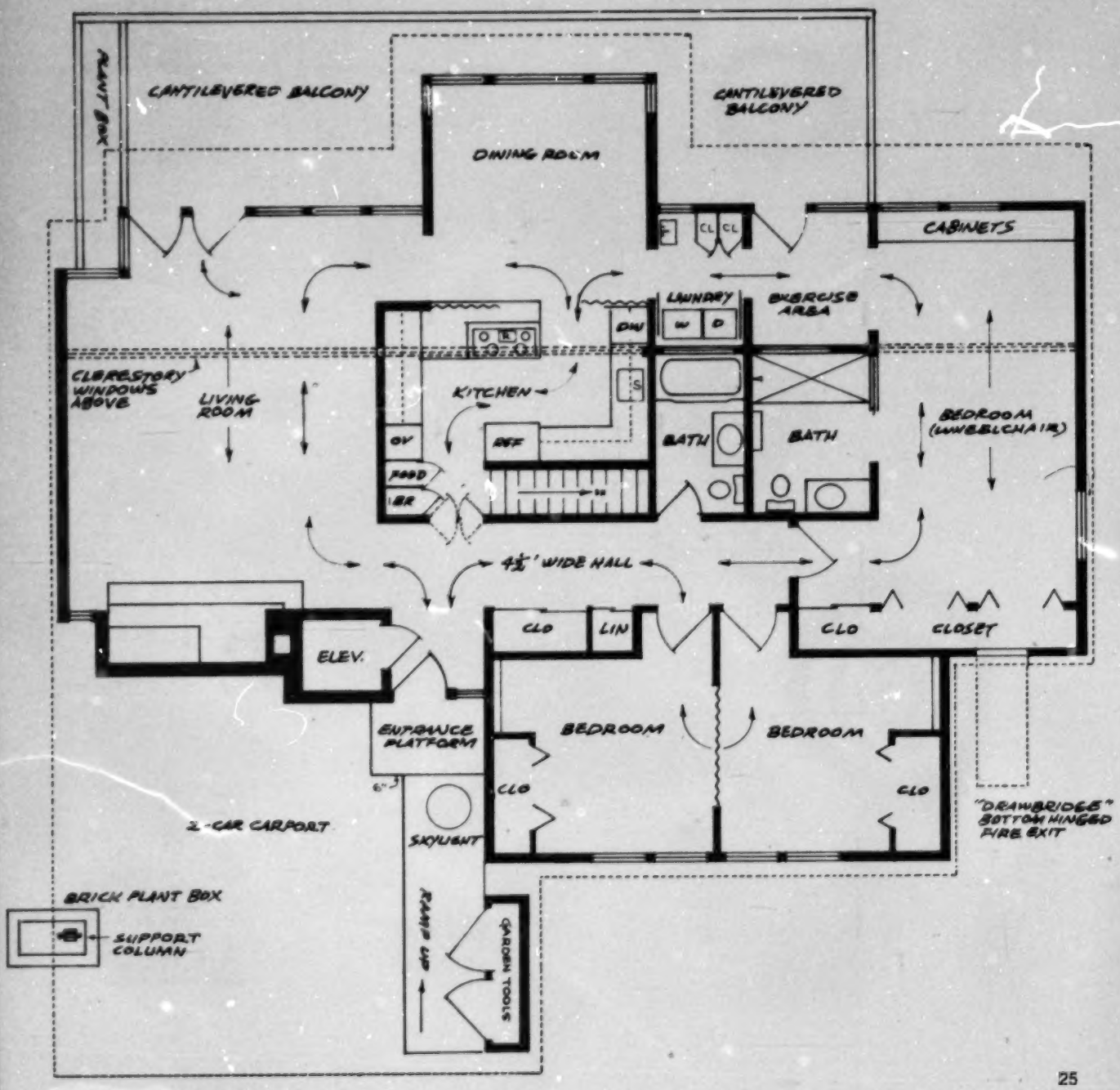
The children's bedrooms, which adjoin each other, are a large playroom area by day, divided by an accordion-type folding door for privacy at night. The kitchen is fully accessible, with all its facilities at reachable levels.

The house is oriented to the south, with a broad roof overhang that guards against the hot, high summer sun while welcoming the warmth of slanting sunlight in the wintertime.

Fixed clerestory windows protected by an "eyebrow" overhang run the length of the house, bringing year-round brightness to interior rooms.

Situated on a slope leading to a wooded ravine on land that might have been considered impractical for wheelchair accessibility, the house and its entrance face north are level with the access road. On the south side, however, the main floor is a full story above ground level, with a basement opening to a flagstoned patio outside the door. The basement is finished to include a guest bedroom and bath and a playroom. These rooms and the back patio are accessible by elevator from the main floor.

Note the unique emergency exit inside a closet in the main bedroom (far from the front entrance). It is a bottom-hinged push-out door that becomes a drawbridge wide enough for a wheelchair, as is the closet entrance itself.



DEMONSTRATION HOUSE NUMBER TWO

This house was adapted for a chairborne homemaker from a builder's plan. Excellent two-way movement is provided in the family and social activities area. Not even the crowded conditions of a social gathering would impair too much the mobility of the wheelchair resident.

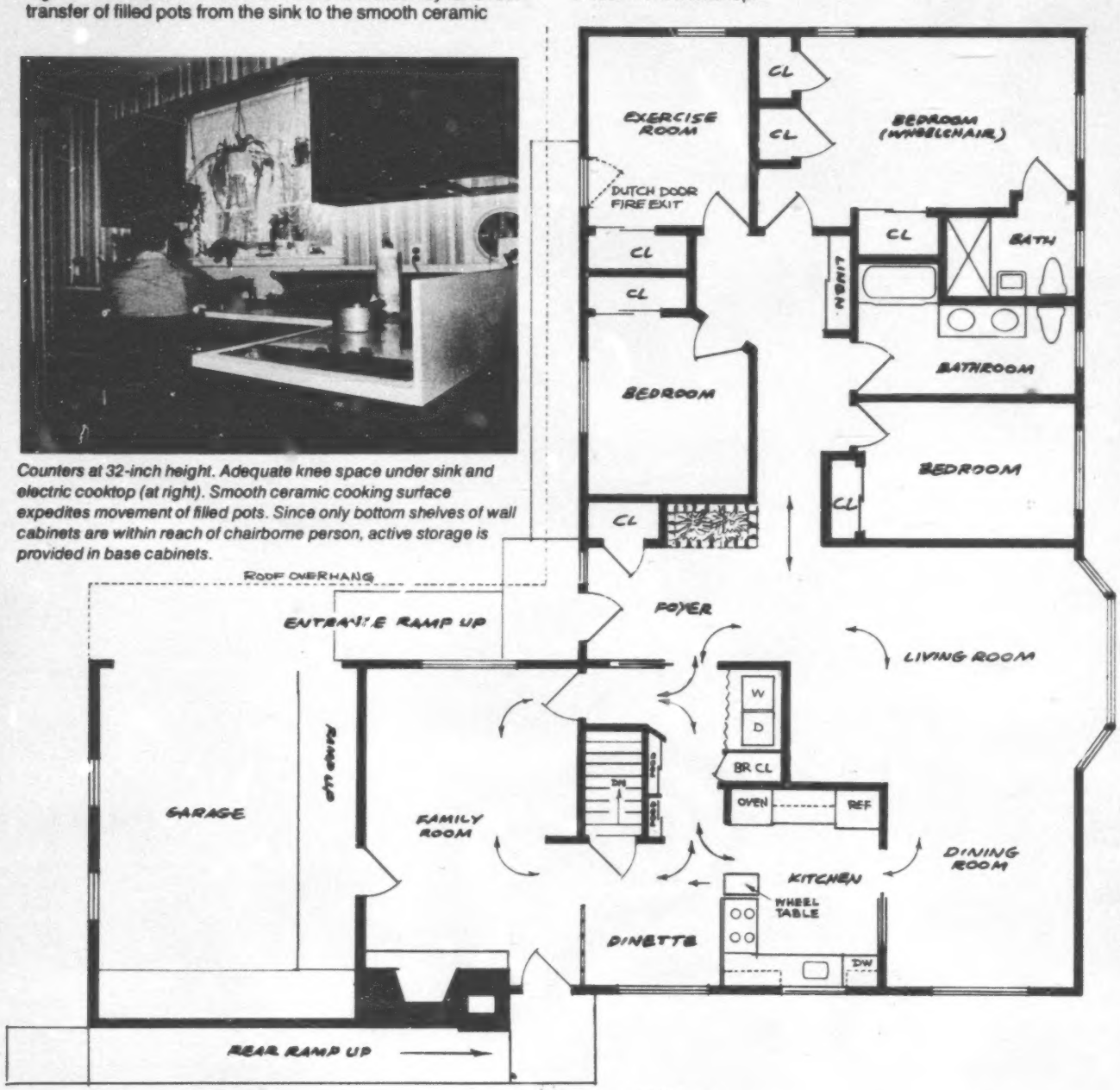
To overcome the fact that the house floor is about a foot and a half above ground level, a gently rising ramp approaches the entrance under a sheltering roof overhang. Another ramp in the garage leads to the inside doorway, and a third one in the rear gives access to the backyard and its outdoor facilities, including a sunken swimming pool.

Adaptations in the kitchen include counter tops 32 inches high for comfortable wheelchair use and a slideway for direct transfer of filled pots from the sink to the smooth ceramic surface of the electric cooktop. A wheeled cart serves to bridge the gap between these facilities and the refrigerator-freezer and built-in wall oven. The cleaning accessories—washer, dryer, broom closet and others—and food storage are conveniently close to the kitchen area.

A wide hallway off the foyer makes all parts of the bedroom wing accessible. A screened "Dutch"-style (two-part) door in the exercise room serves as a window and ventilator when the upper half is open. Fully opened as a door, it is an emergency fire exit.

The second wheelchair owner of this house (a member of the PVA) installed a stairway chair lift in order to be able to reach a basement workshop.

Counters at 32-inch height. Adequate knee space under sink and electric cooktop (at right). Smooth ceramic cooking surface expedites movement of filled pots. Since only bottom shelves of wall cabinets are within reach of chairborne person, active storage is provided in base cabinets.



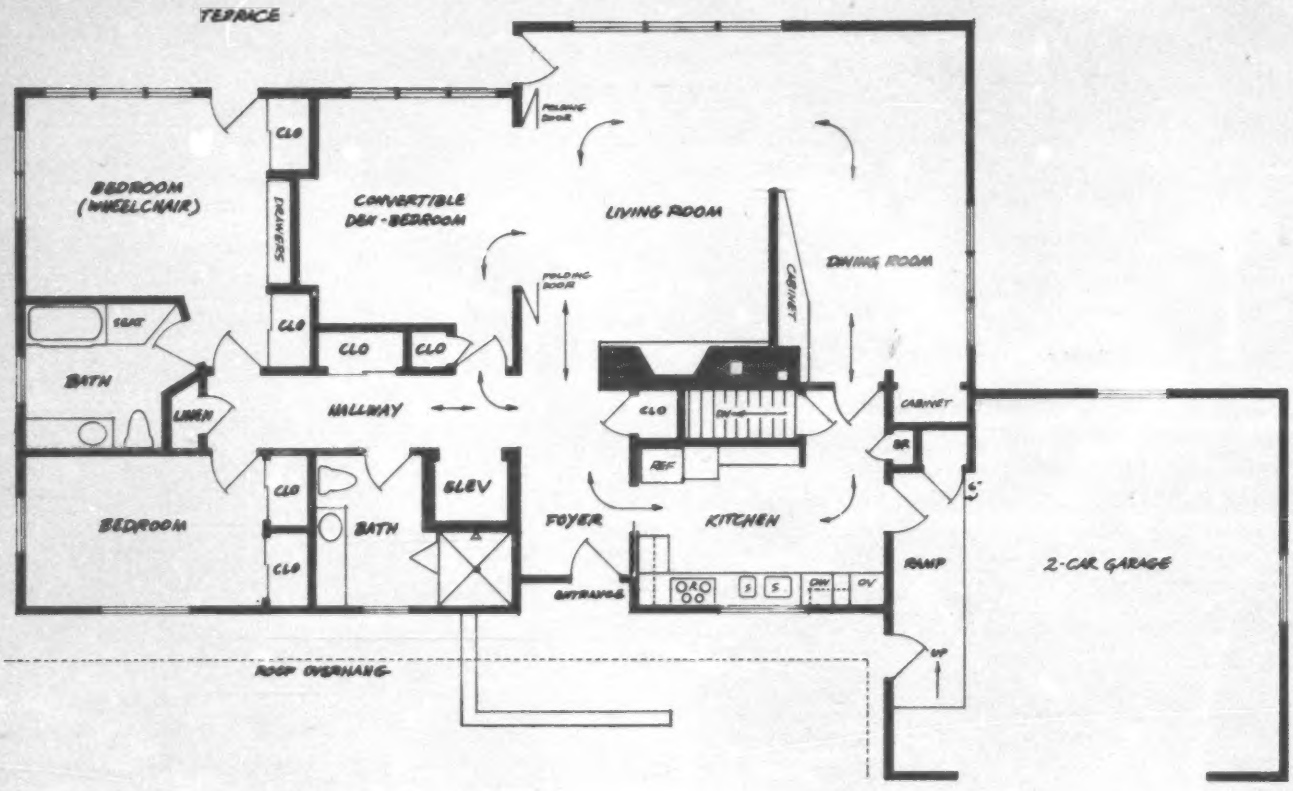
DEMONSTRATION HOUSE NUMBER THREE

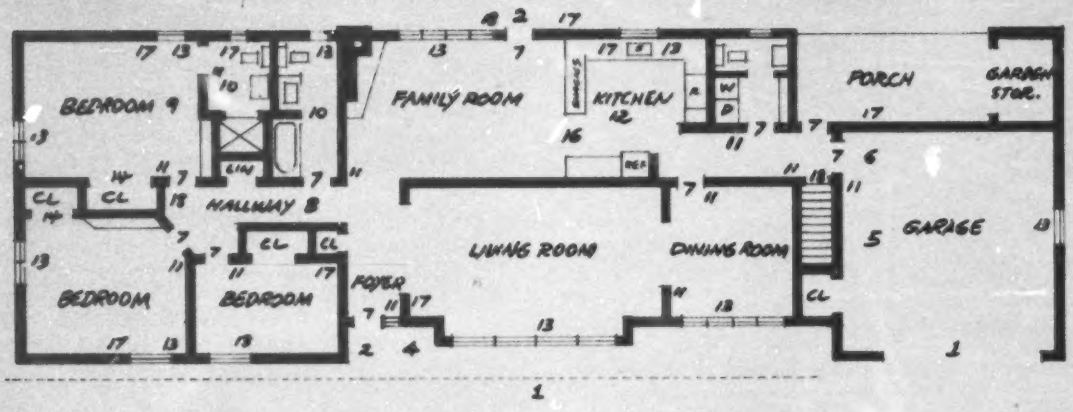
Despite its modest size, this house gives a spacious appearance and easy wheelchair mobility. The open floor plan provides two-way circulation in the family and social activities areas. In addition to the two bedrooms, a library-den is convertible to a guest bedroom, which can be closed off for privacy by a folding door-wall. A side-hung door leading to the hall then serves for access. When the door-wall is open, the den adds a feeling of lavish size to the living area.

The two large bathrooms, each with enough space for complete turns, are both designed for wheelchair convenience. They include a wheel-in shower in one and a tub with a built-in transfer seat at one end in the other. Both rooms have wheel-under wash basins sunk into countertops, with wall-size mirrors above and supply cabinets to one side, under the counters.

The large, cheerful kitchen is an important part of the open, circulating floor plan. It has plenty of space for a snack table. This room was not designed as a wheelchair-work-kitchen for the chairborne resident, so counters are at standard 36-inch height.

A custom-built, non-commercial elevator gives access to the basement; it is inspected regularly and maintained by the designer, an engineer friend of the owner.





ALTERING A BUILDER'S PLAN

A builder who buys a tract of land for the development of a residential community may offer a choice of several house plans. Often, a set of model homes is built. These may be decorated and furnished demonstrations of each building plan to aid a prospective purchaser in visualizing the transition from a plan on paper to three-dimensional reality.

Such models can be very effective in helping the chairborne individual and his or her family to make decisions concerning the potential of any of the plans for wheelchair living, and the extent of the changes necessary for actual, functional use. A builder's model house is the equivalent of any existing house being examined for possible purchase and alteration, but with an important advantage. Nothing will have to be torn down and rebuilt. Corrections, if acceptable to the builder, will be made in the plan and may then add very little to the basic cost of the house construction.

Here's a checklist of the minimum requirements for a house to be built or remodeled for functional wheelchair living:

1. **Site.** Level, with sufficient grade for drainage.

2. **Access.** No steps, front or rear, inside or out. If ramping is necessary the slope must not exceed 1 inch of rise for every 12 inches of length. If a basement is planned, a deeper foundation may be necessary to lower the house to an acceptable level. Find out about the ground water level and possible seepage problems in the area.

3. **Ramps** must be at least 42 inches wide, made of permanent, fireproof material, with a surface to prevent slipping when wet.

4. **Ramp approaches** to front and rear doorways must have level platforms at least 5 feet square. Entrance platform and interior floor must be at identical levels; no step up or down.

5. **Garage or carport** must be wide enough to allow maneuvering of the wheelchair for transfer to and from the car. It is important to consider in planning whether the chairborne resident habitually uses the passenger's or the driver's side of the car for transfers, because in most cases a change is virtually impossible.

6. **Entrance to the house** should be possible directly from within the garage or carport. If not, a pathway from the car shelter to the house entrance should be roofed over and sheltered from the weather.

7. **All doorways,** inside and out, should be 36 inches wide. In the event that this width for some **interior** doors may not be feasible, the minimum allowable width is 32 inches. The use of special "full-clear-opening" hinges for such doors is recommended.

8. The **hallway** should be no less than 42 inches wide. This will permit a 90 degree turn by the wheelchair into a 36 inch door opening. However, a 48 inch wide hallway is a much more practical minimum for the average wheelchair, and serious effort should be directed to modifying a house plan to meet this minimum.

9. The **bedroom** to be occupied by the chairborne resident must be adequately large for wheelchair maneuvering. Give thought to the potential placement of furniture and any special equipment such as a transfer lift. Direct and easy access to a bathroom is essential.

10. The **bathroom** is vital in the activities of everyday living for the chairborne person. It must be planned for comfortable access to and use of each fixture. Check the pointers concerning showers, washbasins and so on in the bathroom section of this manual. Consider the possiblity of taking space from an adjoining room, if necessary, to enlarge the wheelchair bathroom. IF A PROPER WHEELCHAIR - BATHROOM CANNOT BE ACHIEVED IN THE PLAN UNDER CONSIDERATION, REJECT THE PLAN.

11. **Electric wall switches** to be installed 36 inches above the floor; outlets 18 inches high, all at comfortable reach levels from wheelchair. Plan for multiple switch control as needed, delayed action switches, remote control systems. Service entrance panel (with master switch and fuses or circuit-breakers) must be reachable from the chair.

12. If the chairborne person is the homemaker, plan the **kitchen** accordingly, with lowered base cabinets and other features for comfortable, efficient functioning. This may be the most costly modification in the house plan and must be given very careful study.

13. **Windows** should be operable from the wheelchair. If double-hung windows are in the original plan, arrange for a change to casement or awning type, with built-in inside screening. Consider the advantages of insulating glass.

14. Lowered hanger rods in **clothes closets**.

15. Discuss and consider choices available for low maintenance exterior and interior surfaces.

16. **Can the house plan be opened to improve traffic circulation? A simple change may make a world of difference for easier living!**

17. Consider a built-in **intercom system** with call boxes in appropriate locations in the house.

18. Install **UL approved smoke detector alarms** and plan an emergency **fire exit** that can be used by the chairborne resident as well as others in the house.

THE WHEELCHAIR

The modern folding wheelchair is a remarkable development of the twentieth century, an indispensable device that provides mobility for the person physically unable to walk. Whether manually operated or electrically motorized, the chair is made in a wide range of qualities, styles and prices.

It is reasonable to assume that a chairborne person planning a wheelchair house has given considerable thought to the choice of a wheelchair most suited to his or her needs, has been using this chair for some time and will be using it, or one like it, for the forseeable future.

Many active chairborne people put in as many as eighteen consecutive hours in their chairs in the course of a busy day. So the choice of so intimate a piece of equipment cannot be casually made. One does not just "buy a wheelchair". It must be carefully prescribed for proper fit and comfort, the need for special features and accessories and the finest available quality. The measurements and weight of the individual, his or her physical limitations, and the activities for which the chair will be used must all be factors in arriving at the choice.

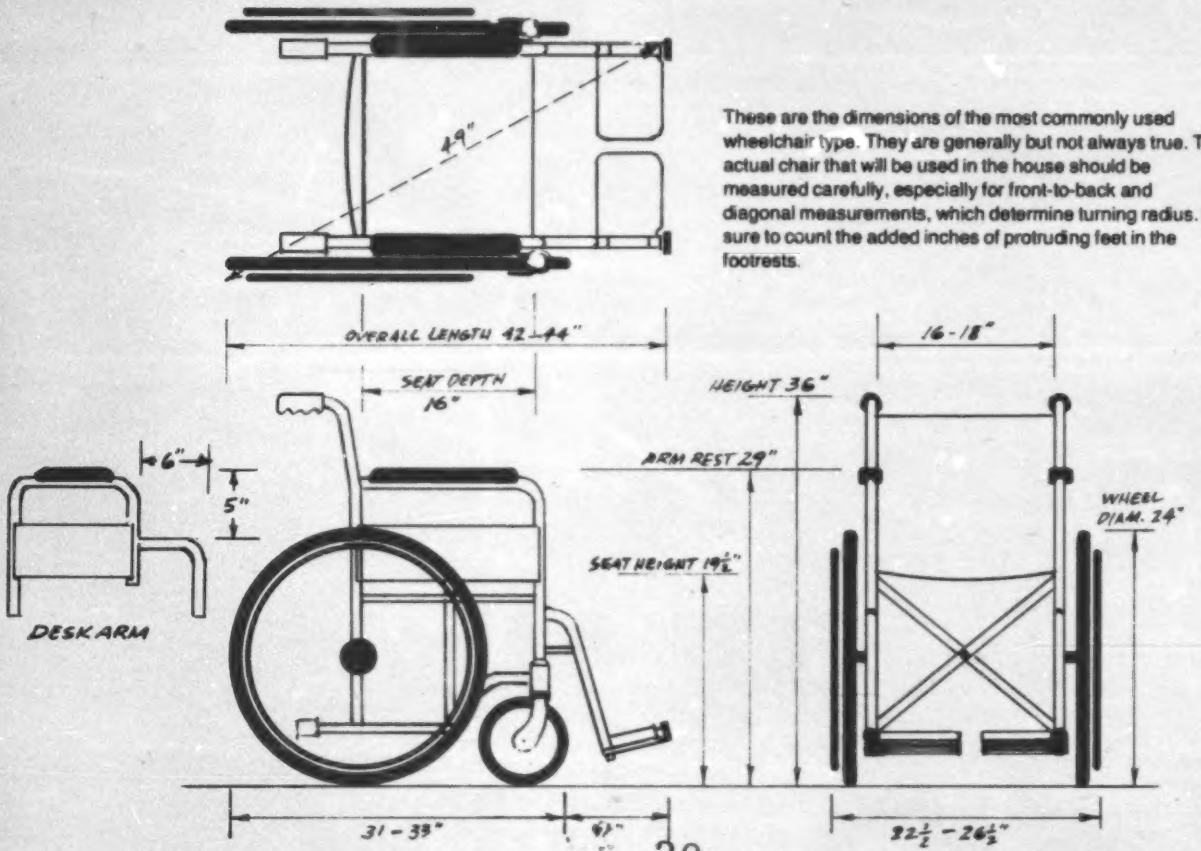
The dimensions of specific details and areas of a wheelchair house must obviously be related to the dimensions of the chair, as well as to its ability to be maneuvered smoothly and efficiently within all parts of the house. While variations in the lengths and widths of most adult-size chairs would seem to be rather small, such differences may determine the ability to get through a doorway or turn a corner in a hall.

The average wheelchair occupies 7½ square feet of floor space, in sharp contrast to the 1½ square feet covered by the average adult standing on two legs. Adult chairs generally range from 22½ to 26½ inches wide, 42 to 44 inches long overall, including footrests. For the individual whose legs must be maintained in a horizontal position, special elevating legrests may increase the overall length to 54 inches. On the other hand, one who does not need the usual footrests can use a chair that may be only 34 inches long.

These and other variations in chair dimensions will affect the turning radius, maneuverability and space requirements of the chairborne person. For this reason the architect or designer must study the person in the very chair to be used in the house, learn what it can and cannot do, and plan critical dimensions realistically. In addition it is not unusual for an architect to spend some time in the wheelchair and personally develop a sense of its mobility as well as its limitations in restricted space areas. There is much that can be gained from such an experience.

A hallway in a builder's plan, or in an existing house, may be as narrow as 36 inches, not an unreasonable width for an ambulant person. But for the 42 inch long wheelchair, it can only go forward or back up; it cannot make a complete reverse-direction turn. A 4½ foot wide hallway is needed for such a turn, and plans should call for this minimum. Bedroom passage spaces, bathroom floor space, the kitchen, all should be analyzed for accessibility of the chair being studied. A chair with legrests raised to an overall length of 54 inches will, of course, have a larger turning radius than the 42 inch chair.

The usual height of a wheelchair at the top of its arm rests (important when moving under wash basins, work tops, desks and the like) is about 29 inches. Use of desk-type arms with their lower forward section permits moving the chair closer in under surfaces that may otherwise be too low for a comfortable approach.



These are the dimensions of the most commonly used wheelchair type. They are generally but not always true. The actual chair that will be used in the house should be measured carefully, especially for front-to-back and diagonal measurements, which determine turning radius. Be sure to count the added inches of protruding feet in the footrests.

THOUGHTS ON SAFETY

These suggestions will not cover all possibilities, but should point the way to planning for safety:
FIRE is probably the most important hazard in a wheelchair home.

• **Smoke Detector Alarms** can provide early warning, are inexpensive and easy to install. Locate alarms on the ceiling or on the wall high up, close to the ceiling, between the sleeping area and potential sources of fire such as the kitchen, garage, furnace room, and at the top of basement stairwell. *Do not* locate smoke detector *in* the kitchen, where smoke from cooking will set off false alarms; or *in* the garage, where the exhaust of a car entering or leaving can set it off. *Do* place an alarm in any room where a smoker sleeps!

Smoke detectors should be battery operated, or if powered by house current, should have an automatic battery back-up that takes over if the house current should fail. All smoke detector alarms should be tested regularly.

• **Extinguishers** are sensible if they will be used sensibly—on small fires *only*. Large extinguishers are probably outside the capabilities of most chairborne persons. They are heavy, weigh 30 to 40 pounds, and difficult to operate.

Small extinguishers, about 4 to 9 pounds, are effective on *small* grease, oil, gasoline and electrical fires. Consider only the carbon dioxide (CO_2) or the *multipurpose* dry chemical types. Carbon dioxide is preferable in the kitchen because it evaporates completely, leaves no residue and does not harm food. The *multipurpose* dry chemical units are effective on combustibles such as wood, paper and cloth, in addition to oil, grease and electrical fires. Look for a minimum UL (Underwriters' Laboratories) rating 1-A:10-B:C. The letters stand for fire categories: A, wood, paper and cloth. B, grease, oil and other flammable liquids. C, involving electric current. A carbon dioxide extinguisher is rated only B and C, so will not put out a paper fire. You would need the *multipurpose* dry chemical, rated A, B and C, rather than the *ordinary* dry chemical, rated only B and C.

DO NOT ATTEMPT TO FIGHT A SPREADING FIRE! GET OUT AND GET HELP!

• **A safety exit,** either a regular back door or a specially constructed one usable by a wheelchair, should be in the house plan. (See examples in house plans illustrated.)

• **Automatic, battery powered emergency lamps** in key areas, such as bedrooms, should light when the house electrical system fails; they are plugged into the system to maintain full charge and to receive the fail signal.

• **Kitchen accidents** can cause fires and other damage:

• A cooktop or range should not be placed under or near a window. If the existing range is so placed, do *not* use window curtains. Do not use toasters, griddles, broilers and other heating devices close to curtains, paper-towel dispensers or other flammable objects. (This applies to electric heaters and other such devices elsewhere in the house.)

• Do not wear loose sleeves near oven or range burners. Avoid reaching over a turned-on burner to reach controls or another burner; use a reaching device or reach from the side. Use long, up-to-the-elbow insulated mittens when reaching into a hot oven.

• A fat fire in an oven or broiler can be extinguished by turning off the heat and closing the door to smother the flames by cutting off the air supply. A fat or grease fire on top of a range or work surface can be smothered with large amounts of salt or baking powder. NEVER POUR WATER ON A FAT OR GREASE FIRE. THAT WILL SPREAD IT.

• If a gas oven or range has no pilot light, use long barbecue-type matches, especially in the oven. Light a match and put it in the oven or lay it across a range burner, *then* turn on the gas. Or use a flint sparking device.

• To avoid **scalding,** use a ladle to handle hot liquids; do not pour them from one vessel to another. Slide hot, filled pots or use a wheeled table instead of carrying them. If they must be carried, use a solidly based wheelchair tray, attached to the chair, *not* a lap tray. Avoid sudden movements or bumps such as in crossing a doorsill.

• Use only flat-bottomed, non-tipping kitchen utensils. Pots and pans on a range should always have handles turned away from the front. Do not use pans with loose handles. Use long-handled stirrers, especially in working at the rear of the range; use a mirror on a stick to look into back-burner utensils. Prevent hot splatters by covering open frypans or deep fryers with a mesh guard.

• Food heating in the original can, if unopened, will build up steam pressure that may squirt hot liquid when opened; open it *before* heating.

• Knives and other sharp tools should never be stored loose in a drawer or box; use slotted storage racks. In washing knives, do not dump them into a sink or dishpan.

• To avoid breakage accidents, use light, unbreakable utensils, dinnerware and the like. If heavy objects must be used, store them low. Do not use reaching devices to bring heavy objects down from high-up storage.

• Make sure all heavy electrical appliances and tools are grounded. Check all appliances for broken cords, frayed insulation and the like. Never use a cord that has been wetted. Never use appliances near a sink or bathtub. Disconnect electric appliances such as beaters, carving knives and blenders before removing and washing the blades.

• Avoid **wheelchair accidents** by providing proper safeguards on lift platforms, ramps, the tops of stairways. Most wheelchairs are ruggedly well made, but do require reasonable maintenance for trouble-free operation. Be sure upholstery is in good condition and well secured; brakes are adjusted and operative; hand rims are firmly attached; wheels are adjusted for easy turning without "wobble", are properly lubricated, have bearings in good condition, and have good tires, whether solid rubber or pneumatic. If spokes are missing or loose, replace them and check alignment to avoid distortion of the wheels. Try to keep the shiny metal clean and nicely polished. A well kept wheelchair is safer and better for morale.

FOR MORE INFORMATION

DESIGNING FOR THE DISABLED (Second Edition, 1967) by Selwyn Goldsmith, Associate, Royal Institute of British Architects. Researched and written for the architect, interior designer and civic planner. Precise and detailed instructions for building to meet the needs of the physically handicapped. McGraw-Hill Book Company, 1221 Avenue of the Americas, New York, N.Y. 10020 $15.00

WHEELCHAIR BATHROOMS by Harry A. Schweikert, Jr. 1971. An illustrated manual to serve as a guide in the development of a bathroom for the chairborne individual. Accessibility, comfort, safety and thorough descriptions of the many variations possible in types, measurements and adaptability of bathroom utilities. Paralyzed Veterans of America, 7315 Wisconsin Avenue, Washington, D.C. 20014

THE WHEELCHAIR IN THE KITCHEN by Joseph Chasin and Jules Saltman. 1973. Overall planning and a detailed analysis of components of a kitchen for the chairborne homemaker. Takes into consideration the person, the wheelchair and choices available in adapting a kitchen environment to offset the disability. Paralyzed Veterans of America. $2.50

SPACE AND DESIGN REQUIREMENTS FOR WHEELCHAIR KITCHENS by Helen E. McCullough and Mary B. Farnham. Statistical results of a research program to provide definite dimensions for circulation space, range of access for storage, clearances for knees and chair arms, and comfortable work heights. Includes wheelchair and body measurements and reach charts. Bulletin 661, June 1960, University of Illinois Agricultural Experiment Station, Urbana, Illinois 61803. 50¢

KITCHEN PLANNING STANDARDS, Index Number C5.32, March, 1965. 15¢ Small Homes Council-Building Research Council, University of Illinois, One East Saint Mary's Road, Champaign, Illinois 61820

LAUNDRY AREAS: SPACE REQUIREMENTS AND LOCATIONS. Index Number C5.4, December, 1957. 15¢. Small Homes Council—Building Research Council, University of Illinois, One East Saint Mary's Road, Champaign, Illinois 61820

TELEPHONE SERVICES FOR THE HANDICAPPED by Richard A. Sullivan, M.D., Fred H. Frieden, M.D. and Joy Cordery, M.A.O.T., O.T.R. 1968. Sponsored and supported by the American Telephone and Telegraph Company, this two year study shows the difficulties in using a telephone encountered by the many types of disabled persons, and the assistance that suitable equipment can provide. Case histories, and profusely illustrated with photographs and drawings. Rehabilitation Monograph XXXVII. Institute of Rehabilitation Medicine, New York University Medical Center, 400 East 34th Street, New York, N.Y. 10016. $1.50

AIDS TO INDEPENDENT LIVING (Self Help for the Handicapped) by Edward W. Lowman, M.D. and Judith Lannefeld Klinger, O.T.R., M.A., Institute of Physical Medicine, New York University Medical Center. An encyclopedia of information covering every aspect of living and solutions to problems in a broad spectrum of disabilities. Contains 65 categories of basic activity. Thoroughly illustrated with thousands of photographs and drawings. Source list. 1969. McGraw-Hill Book Company, 1221 Avenue of the Americas, New York, N.Y. 10020. $40.00

MEALTIME MANUAL FOR THE AGED AND HANDICAPPED by Judith Lannefeld Klinger, O.T.R., M.A., Fred H. Frieden, M.D. and Richard A. Sullivan, M.D. Includes ideas for the homemaker who uses a wheelchair. 1970. An Essandess Special Edition (Division of Simon and Schuster, Inc.), 630 Fifth Avenue, New York, N.Y. 10020. Paperback, $2.00.

HOMEMAKING FOR THE HANDICAPPED by Elizabeth Eckhardt May, Neva R. Waggoner, Eleanor M. Boettke. Broad coverage, illustrated, from domestic and foreign sources. 1966. Dodd, Mead & Company, Inc. 79 Madison Avenue, New York, N.Y. 10016 $7.50

BARRIER-FREE DESIGN: THE LAW. Research and explanations by Terence J. Moakley. Illustrations by Thomas T. Hodne. Volume 1, 1976. The first volume of a 2-volume publication developed to provide explanations and illustrations of building laws and construction code provisions for accessibility by the physically handicapped in New York City, New York State, Connecticut and Pennsylvania. Although directed toward architects and other professionals concerned with elimination of architectural barriers in public buildings, much of the information can be applied to residential design. Eastern Paralyzed Veterans Association, 432 Park Avenue South, New York, N.Y. 10016.

THE BATHROOM (New and Revised Edition, 1976) by Alexander Kira. An expanded update of the published results, in 1966, of a seven year research program at Cornell University. It is a comprehensive and fascinating investigation into the problems and attitudes concerning personal hygiene both historically and at present. The emphasis is on development of improved design criteria for bathroom facilities in keeping with the potential our advanced technology should make possible. Includes a section on the special problems and needs of the elderly and the disabled. The Viking Press, Inc. 625 Madison Avenue, New York, N.Y. 10022. Paperback, $9.00

WHERE TO GET IT

Most of the construction items described or illustrated in this manual are standard builders' supplies adaptable for wheelchair accessibility. For this reason sources for windows and doors and their hardware, plumbing and electrical fixtures and so on are readily available to the building professionals and are not listed here. Specialty products such as cordless telephones are listed because they may be difficult to locate.

SS Surgical and Rehabilitation Equipment Suppliers
HW Houseware and Hardware Stores and Departments
DS Department Stores
MO Mail Order Houses
ABS Architectural and Building Supply Firms
ES Electrical Supply Firms.
PS Plumbing Supply Firms.
MAR Major Appliance Retailers
KDC Kitchen Designers and Contractors.

Page 5 Ramp railings ABS
Speed-Rail: The Hollaender Mfg. Co., 3841 Spring Grove Avenue, Cincinnati, Ohio 45223

Page 6 Garage doors, remote controlled DS MO
Made by a number of manufacturers, installed and serviced locally.

Page 7 Vertical wheelchair lift SS
The Wheel-O-Vator Division, Toce Bros. Mfg. Ltd. P.O.Box 489, Broussard, La. 70518
R.J. Chairlift Company, Inc. 7228 West Madison, Forest Park, Illinois 60130
American Stair-Glide Corp., 4001 E. 138th Street, Grandview, Missouri 64030
Fred Scott & Sons, 101 Kelly St., Elk Grove, Illinois 60007

Page 8 Clear-opening door hinges, to widen doorways without remodeling: SS
Stanley Hardware, Div. of Stanley Works, New Britain, Conn. 06050
All stores: Med Medical Equipment Distributors, Inc.
Automatic door bottoms: ABS
A builders' hardware product made by a number of manufacturers. Architect or contractor will specify.

Page 10 Intercoms: DS MO Electronic and radio retailers.
Telephone Equipment: Local telephone company.

Page 11 Cordless telephones: HW DS MO
Kari-Fone; Kari-Fone Corp. 86-55 Broadway, Elmhurst, N.Y. 11373 Eton Phone Co., 555 Greenbrier Dr. #29, Oceanside, Ca. 92054

Page 12 Whistle Switch: HW MO Mark Engineering Inc., 34 Tower Street, Hudson, Mass. 01749
Battery operated floodlamps: ES

Page 14 Stairway chair lifts and wheelchair lifts:
Made and installed by a number of manufacturers, including The Cheney Company, 3015 S. 163rd St., New Berlin, Wis. 53151
Earl's Stairway Lift Corp. 2513 Center St., Cedar Falls, Iowa 50613
American Stair-Glide Corp. See listing re: Page 7
Butler Wheelchair Lift (photo, page 14, top) 390 Eberts Lane, York, Pa. 17105
Inclinator Company of America, 2211 Paxton St. Harrisburg, Pa. 17105
R.J. Chairlift Company. See listing re: Page 7

Page 15 Elevators: See listing re: Page 14

Page 16 Kitchen equipment: HW DS MAR KDC

Page 20 Wall hung wash basins: PS
Grab bars: SS ABS PS

Page 21 Unitized Roll-in shower. The Braun Corp. 1014 S. Monticello, Winamac, Indiana 46996
Shower chairs: SS MO Everest & Jennings, Inc. 1803 Pontius Avenue, Los Angeles, Calif. 90025
Nelson Medical Products, 5690 Sarah Ave. Sarasota, Fla. 33581

Mr. Bidet: AMW Enterprises, P.O. Box 252, Dayton, Ohio 45405

Page 22 Shower and tub scald preventers:
APOR Industries, 251 West Garfield Road, Aurora, Ohio 44202

Page 23 Bed-to chair transfer: SS MO
Hoyer Patient Lifter: Ted Hoyer & Co., Inc. 2222 Minnesota St. Oshkosh, Wis. 54901
Everest & Jennings, Inc.
Nelson Medical Products
Trujillo Industries, 5726 West Washington Blvd. Los Angeles, Calif. 90016

Page 30 Fire Extinguishers: HW DS Local retailers and extinguisher recharging services.
Smoke detector alarms: HW DS MO